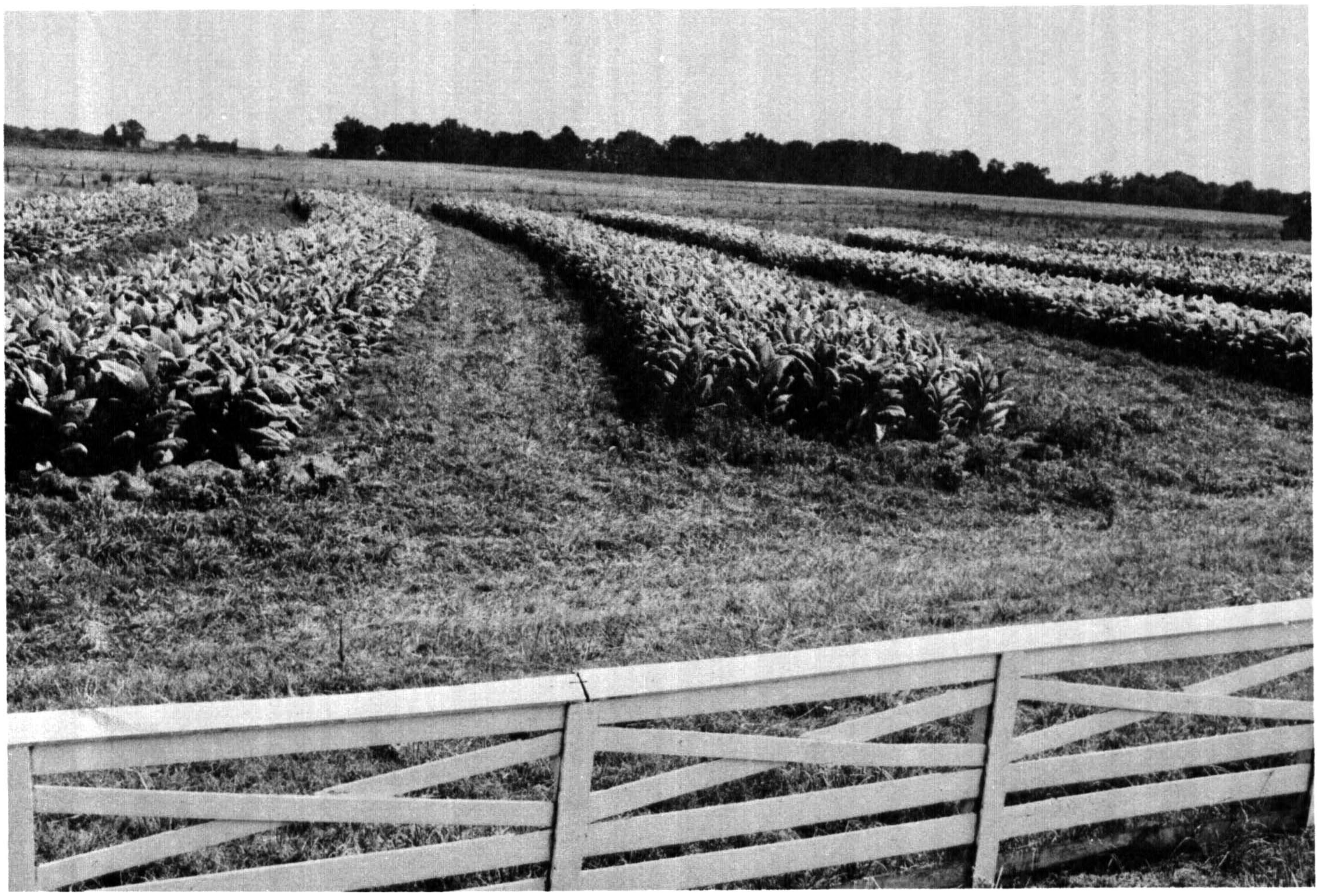
SOIL SURVEY OF

Logan County, Kentucky



United States Department of Agriculture
Soil Conservation Service
In cooperation with
Kentucky Agricultural Experiment Station

Major fieldwork for this soil survey was done in the period 1966–70. Soil names and descriptions were approved in 1972. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1970. This survey was made cooperatively by the Soil Conservation Service and the Kentucky Agricultural Experiment Station. It is part of the technical assistance furnished to the North Logan County and South Logan County Soil Conservation Districts.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, United States Department of Agriculture, Washington, D.C. 20250.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Logan County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the woodland suitability group to which the soil has been assigned.

Individual colored maps that show the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those that have a moderate limitation can be colored yellow, and those that have a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the the capability units and the woodland suitability groups.

Foresters and others can refer to the section "Use of the Soils as Woodland," where the soils of the county are grouped according to their suitability for trees.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Use of the Soils for Wildlife."

Community planners and others can read about soil properties that affect the choice of sites for dwellings, industrial buildings, and recreation areas in the section "Use of the Soils for Town and Country Planning."

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

Newcomers in Logan County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given in the section "General Nature of the County."

Cover: **Burley tobacco growing on a Pembroke silt loam. The tobacco is in narrow contour strips, and grass sod is between the strips.**

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SOIL SURVEY OF LOGAN COUNTY, KENTUCKY

BY JAMES W. DYE, ARLIN J. BARTON, AND RONALD D. FROEDGE, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE KENTUCKY AGRICULTURAL EXPERIMENT STATION

LOGAN COUNTY is in the south-central part of Kentucky (fig. 1). It has an area of approximately 563 square miles, or 360,130 acres. In 1970 the population was 21,240. Russellville is the county seat.

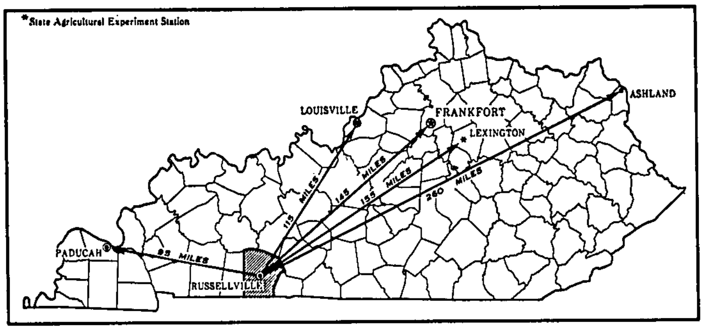

Figure 1.—**Location of Logan County in Kentucky.**

Logan County is mainly a diversified farming area, and the principal crops are burley and dark tobacco, corn, and soybeans. Dairy farming and raising beef cattle are the leading livestock enterprises. The city of Russellville recently cooperated with the Soil Conservation Service of the U.S. Department of Agriculture in constructing Lake Herndon, a multipurpose structure that has a capacity of 700 million gallons of water. The town of Lewisburg has also participated in a similar multipurpose project. This abundance of fresh water has played an important role in attracting industry. Approximately 2,100 people are employed by industry in Russellville alone.

Logan County lies in the southern part of the western Kentucky coalfield and the northern part of the Western Pennyroyal physiographic area of Kentucky.

The temperate climate is favorable for many kinds of plants and animals. Generally, summers are warm and humid, and winters are moderately cold. Precipitation generally is fairly well distributed throughout the year.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Logan County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes; the size and speed of streams; the kinds of native plants or crops; the kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Pembroke and Nolin, for example, are the names of two soil series. All the soils in the United States that have the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Pembroke silt loam, 2 to 6 percent slopes, is one of several phases within the Pembroke series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series or of different phases within one series. One such kind of mapping unit shown on the soil map of Logan County is the soil complex.

A soil complex consists of areas of two or more soils, so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. Generally, the name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Rock outcrop-Fredonia-Colbert complex is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, so severely eroded, or so variable that it has not been classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Gullied land is a land type in Logan County.

While a soil survey is in progress, soil scientists take soil samples needed for laboratory measurements and for engineering tests. Laboratory data from the same kind of soil in other places also are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kind of soil. Yields under defined management are estimated for all the soils.

Soil scientists observe how soils behave when used as a growing place for native and cultivated plants and as material for structures, foundations for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this failure to the slow permeability of the soil or to a high water table. They see that streets, road pavements, and foundations for houses are cracked on a named kind of soil, and they relate this failure to the high shrink-swell potential of the soil material. Thus, they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Logan County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association can occur in another, but in a different pattern.

A map that shows soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The soil associations in Logan County are described in the pages that follow. The general soil map of Logan County joins the general soil map of adjacent Robertson County, Tennessee. The detailed soil map of Logan County, however, does not completely join with the Robertson County map because it reflects changes in the concept and classification of some soil series and different combinations of some mapping units.

1. Frondorf association

Strongly sloping to steep, moderately deep, well-drained soils that are loamy throughout; on uplands

This association consists of strongly sloping soils, mainly on narrow ridgetops, and moderately steep and steep soils on sides of ridges. Areas of this association are dissected by many streams and drainageways (fig. 2). Some of the steepest and most rugged areas in the county are in this association near Lake Malone. Rock outcrop or a cliff 10 to 15 feet high commonly is near the top of the slope; cobblestones and stones are common on the sides of ridges and are numerous just below the cliff. Long, narrow areas of alluvial soils are along streams and drainageways.

This association makes up about 7 percent of the county. It is about 65 percent Frondorf soils. Less exensive soils and land types make up the remaining 35 percent. These are Allegheny and Zanesville soils; Rock outcrop; and areas of stony land, a shallow soil, and a clayey soil on uplands; and Bonnie and Cuba soils on flood plains.

Frondorf soils are on the tops and sides of ridges. The largest acreage is on sides of ridges. These soils commonly have a dark-brown surface layer and a dark yellowish-brown subsoil, and they are loamy throughout. Coarse fragments generally are in the surface layer and subsoil, and the depth to sandstone, siltstone, or shale ranges from 20 to 40 inches.

This association mainly is used for trees, pasture, hay, or wildlife habitat. A small acreage on ridgetops and narrow flood plains is used for row crops. Some areas around Lake Malone are used for recreation. The soils of this association are severely limited for many uses by steep slopes, stoniness, and depth to bedrock.

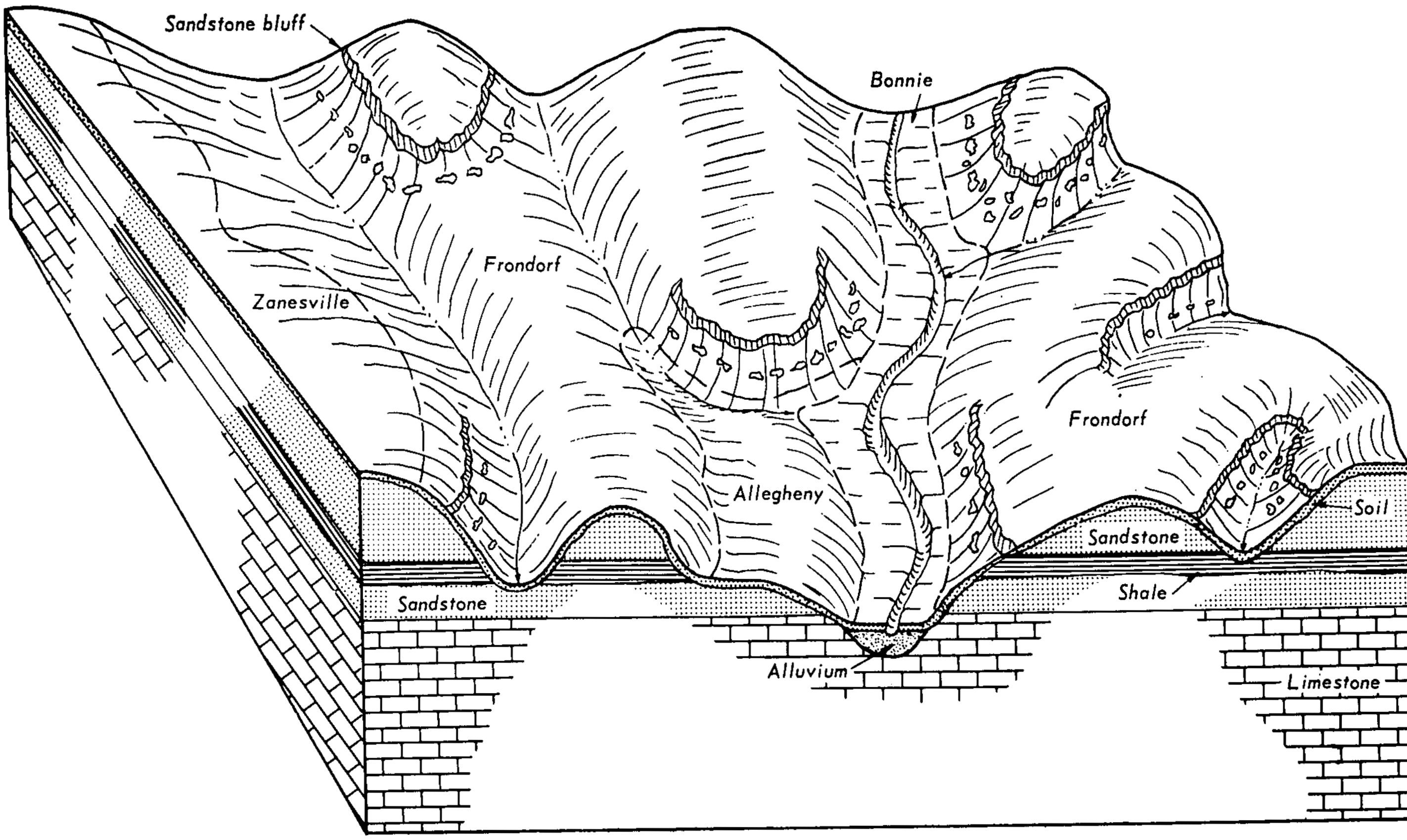

Figure 2.—**Pattern of soils and underlying material in Frondorf association.**

2. *Zanesville-Frondorf-Talbott association*

Gently sloping to steep, deep and moderately deep, well drained and moderately well drained soils that have a loamy or clayey subsoil; on uplands

This association consists of gently sloping and sloping soils on fairly broad ridges and strongly sloping to steep soils on hillsides. The steeper soils are near streams and major drainageways. Part of the association is underlain by sandstone, siltstone, and shale; and part is underlain by limestone. Rock outcrops and stones cover 10 to 20 percent of the surface in some areas that are underlain by limestone. Long, narrow areas of alluvial soils are along streams and drainageways.

This association makes up about 30 percent of the county. It is about 25 percent Zanesville soils, 15 percent Frondorf soils, and 15 percent Talbott soils. Less extensive soils make up the remaining 45 percent. These are Sadler, Colbert, Epley, and Wellston soils on uplands and Nolin, Cuba, Steff, and Bonnie soils on flood plains.

Zanesville soils commonly are on the broader ridgetops. They are well drained to moderately well drained and are deep over bedrock, but they have a compact, slowly permeable fragipan at a depth of about 28 inches. They are loamy in the upper part and clayey below a depth of 3 feet.

Frondorf soils are on the tops and sides of ridges. They are well drained, are moderately deep, and contain coarse fragments. The surface layer typically contains only a few or no coarse fragments, but the number of fragments increases with increasing depth. These soils are loamy throughout.

Talbott soils also are on the tops and sides of ridges. The largest acreage, on sides of ridges, is the steepest soil in the association. These soils are well drained, have a clayey subsoil, and are mostly 2 to 4 feet deep over limestone bedrock. Rock outcrops and stones cover 10 to 20 percent of the surface area.

This association is suited to most crops commonly grown in the county. The steeper soils are unsuited to crops and are used mostly for pasture and trees. The installation of septic tank absorption fields generally is severely limited by depth to bedrock and permeability of the subsoil.

3. *Talbott-Fredonia-Rock outcrop association*

Gently sloping to steep, moderately deep to deep, well-drained soils that have a clayey subsoil; and rock outcrops; on uplands

This association consists of steep soils on knoblike hills and narrow slopes dissected by streams and drainageways (fig 3); gently sloping soils on long, narrow ridgetops; and gently sloping to sloping soils on valley floors. This association is mostly underlain by limestone. Karst topography and sinkholes are common.

This association makes up about 13 percent of the county. It is about 60 percent Talbott soils, 21 percent Fredonia soils, and 6 percent Rock outcrop. Less extensive soils make up the remaining 13 percent. These are Colbert

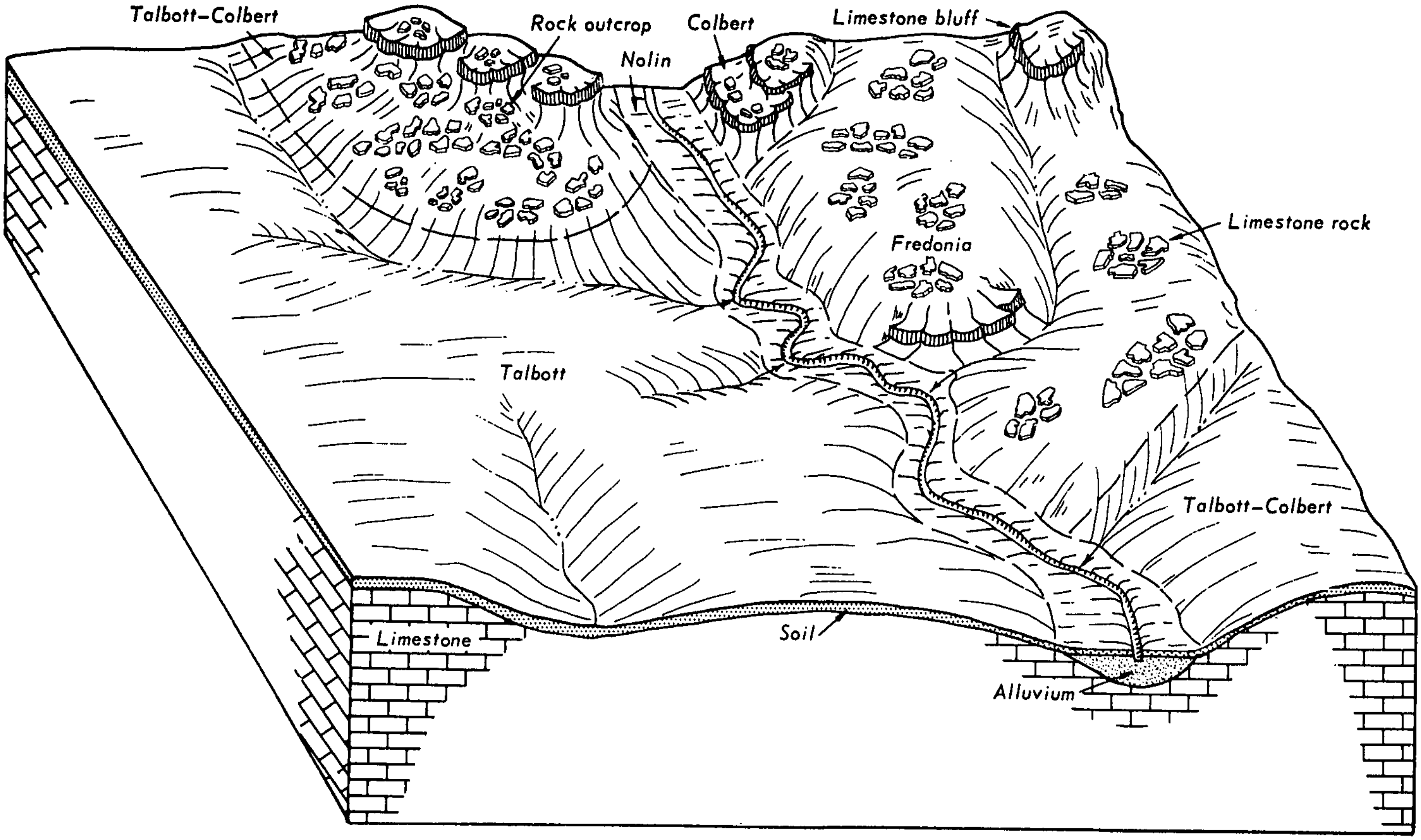

Figure 3.—**Pattern of soils and underlying material in Talbott-Fredonia-Rock outcrop association.**

soils on uplands and Nolin and Lindside soils on flood plains.

Talbott soils commonly are on ridgetops, but they occur on all parts on the landscape. They are well drained and are mostly 2 to 4 feet deep over limestone bedrock. They formed in clayey residuum. Permeability is moderately slow.

Fredonia soils are on ridgetops and in valleys. They are well drained and have a clayey subsoil. Depth to bedrock ranges from 20 to 40 inches. In a few areas limestone outcrops make up as much as 65 percent of the surface area.

Most of this association is wooded or idle. A small acreage is used for pasture and hay.

4. Pembroke-Crider association

Nearly level to sloping, deep, well-drained soils that have a loamy or clayey subsoil; on uplands

This association mostly consists of fairly broad areas of gently sloping soils (fig. 4). Several streams and drainageways cross the association, but some surface drainage is through sinks that connect with underground drainageways. The Pembroke soils do not have the distinct mantle of loess that is characteristic of the Crider soils. The association is underlain by limestone residuum or old alluvium. Long, narrow areas of alluvial soils are along streams and drainageways.

This association makes up about 37 percent of the county and is the largest of the six associations. It is about 56 percent Pembroke soils and 10 percent Crider soils. Less extensive soils make up the remaining 34 percent. These are Pickwick, Talbott, Nicholson, and Baxter soils on uplands and Elk, Newark, Nolin, and Lindside soils on flood plains.

Pembroke soils generally are on broad ridgetops. These soils are gently sloping, well drained, and deep. They have a surface layer of silt loam and a clayey subsoil.

Crider soils are also on broad ridgetops. These soils are nearly level to sloping, well drained, and deep. They have a surface layer of silt loam. The upper 20 to 40 inches of these soils formed in loess. The lower part of the subsoil formed in residuum derived from limestone or old alluvium.

This association is well suited to most crops commonly grown in the county.

5. Melvin-Robertsville-Nicholson association

Level to gently sloping, deep, poorly drained and moderately well drained soils that have a loamy subsoil; on uplands and flood plains

This association mostly consists of nearly level soils on broad, level areas where some shallow basins occur. These basins, of which Mosley Pond is the largest, range from 2 to 75 acres in size. Some do not have surface drainage outlets. The association is underlain by limestone.

This association makes up about 3 percent of the county. It is about 37 percent Melvin soils, 14 percent Robertsville soils, and 10 percent Nicholson soils. Less extensive soils make up the remaining 39 percent. These

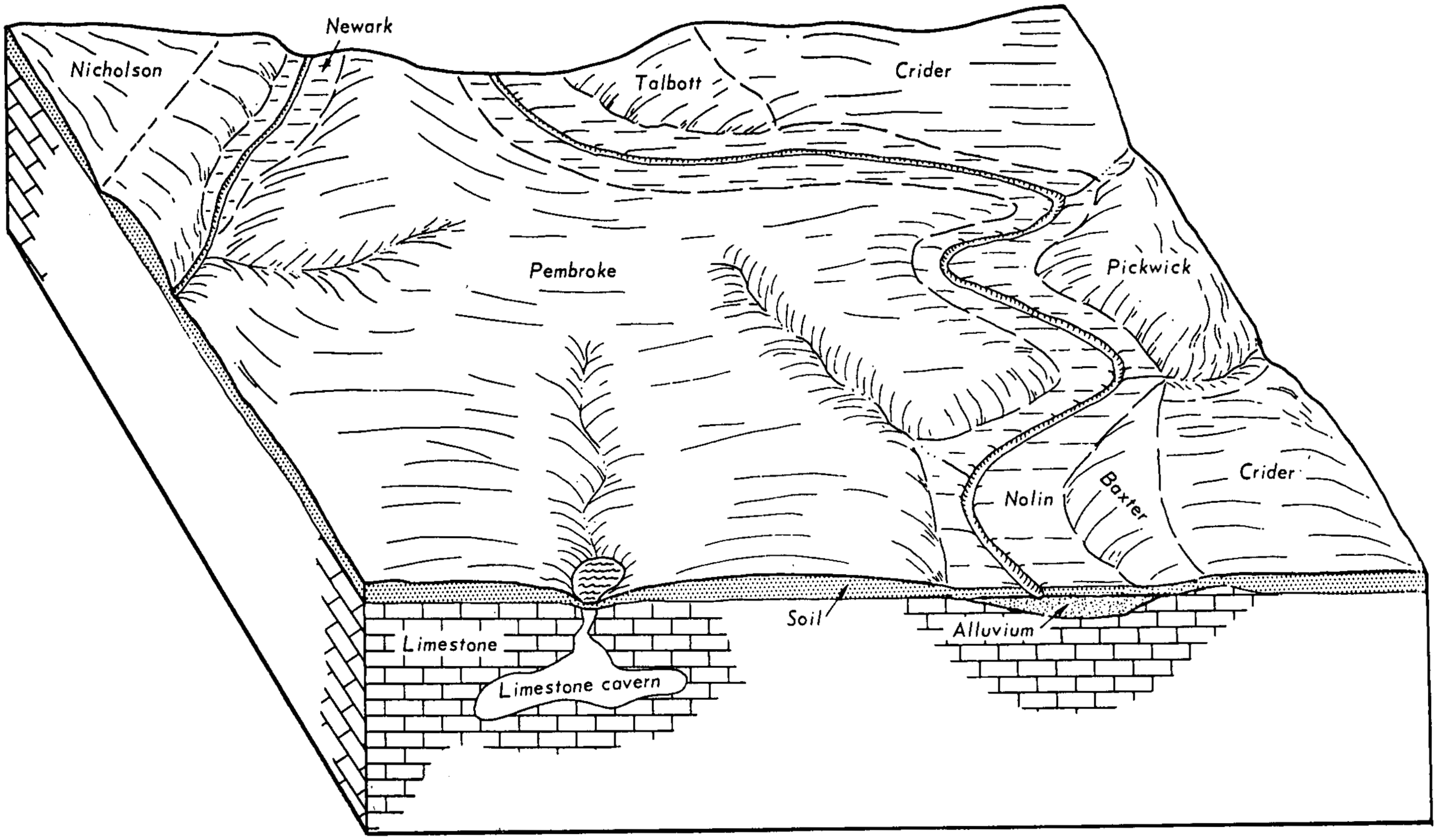

Figure 4.—Pattern of soils and underlying material in Pembroke-Crider association.

are Crider, Elk, and Lawrence soils on uplands and Lindside and Newark soils on flood plains.

Melvin soils commonly are nearly level, but in places they are in slight depressions on flood plains. They are poorly drained, deep, and silty.

Robertsville soils are on smooth uplands and terraces. They also are poorly drained, deep, and silty. They have a fragipan at a depth of 20 to 34 inches.

Nicholson soils commonly are on broad ridgetops. They are moderately well drained and deep and have a slowly permeable fragipan at a depth of 20 to 30 inches.

This association is used mainly for hay and pasture, because it is poorly drained and planting is done late in spring. Some acreage is used for soybeans and grain sorghum. Several of the wetter areas are wooded.

6. Pembroke-Baxter association

Gently sloping to strongly sloping, deep, well-drained soils that have a clayey subsoil; on uplands

This association consists of gently sloping soils on ridges and sloping and strongly sloping soils on hillsides (fig. 5). The more sloping soils are near Red River and other major drainageways. The association is underlain by limestone. Sinkholes and small depressions are common. Long, narrow areas of alluvial soils are along streams.

This association makes up about 10 percent of the county. It is about 37 percent Pembroke soils and 21 percent Baxter soils. Less extensive soils make up the remaining 42 percent. These are Crider, Cumberland, and Nicholson soils on uplands and Nolin and Lindside soils on flood plains.

Pembroke soils generally are on broad ridgetops. These soils are gently sloping, well drained, and deep. They have a surface layer of silt loam and a clayey subsoil.

Baxter soils are on side slopes. These soils are well drained and deep. They have a surface layer of cherty silt loam and a cherty, clayey subsoil.

This association is suited to most crops commonly grown in the county. The more sloping soils are better suited to pasture, hay, and trees than to row crops.

Descriptions of the Soils

In this section the soils of Logan County are described in detail, and use and management of the soils are suggested. Each soil series is described in detail, and then, briefly, the mapping units in that series. Unless specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The

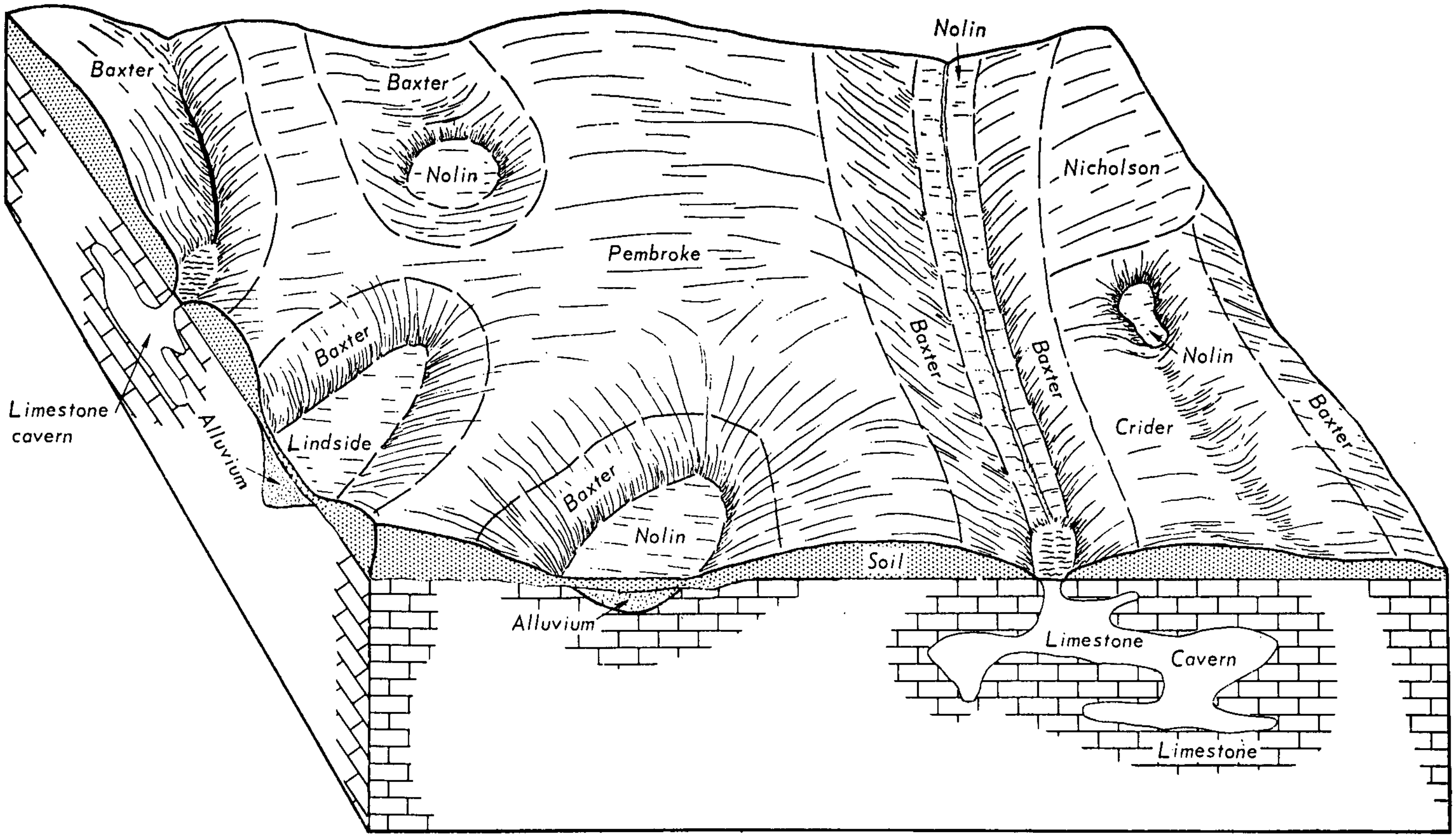

***Figure 5.*—Pattern of soils and underlying material in Pembroke-Baxter association.**

second is much more detailed and is for those who need to make thorough and precise studies of soils. Unless otherwise stated, color terms are for moist soil.

The profile described in the soil series is representative of mapping units in that series. If a given mapping unit has a profile in some ways different from the one described in the series, these differences are stated in the description of the mapping unit, or they are apparent in the name of the mapping unit. The description of each mapping unit contains suggestions about how the soil can be managed.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Gullied land, for example, does not belong to a soil series but, nevertheless, is listed in alphabetic order along with the soil series.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit are the capability unit and woodland group in which the mapping unit has been placed.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*15*).[1]

[1] Italic numbers in parentheses refer to Literature Cited, p. 75.

Allegheny Series

The Allegheny series consists of deep, well-drained soils on old high terraces, foot slopes, and alluvial fans. These soils formed in old alluvium weathered from sandstone, quartzite, limestone, and shale. Slopes are mainly 2 to 12 percent, but in a few areas they range to 20 percent.

In a representative profile the surface layer is brown loam 8 inches thick. The subsoil extends to a depth of about 40 inches. It is yellowish-brown loam in the upper 3 inches, brown and yellowish-brown clay loam to a depth of 30 inches, and mottled brown, red, and light yellowish-brown clay loam in the lower part. The substratum to a depth of 50 inches is mottled red, brownish-yellow, and brown sandy clay.

Allegheny soils have a deep root zone and are moderately permeable. They are generally very strongly acid except where limed.

The more gently sloping Allegheny soils are mostly used for crops, and the strongly sloping Allegheny soils are used for pasture, hay, and trees.

Representative profile of Allegheny loam, 2 to 6 percent slopes, on the northeast side of State Highway 100, 200 feet northwest of intersection with State Highway 1666 and about 1 mile northwest of Simpson County line:

Ap—0 to 8 inches, brown (10YR 4/3) loam; weak, fine, granular structure; very friable; medium acid; clear, smooth boundary.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Area	Extent	Soil	Area	Extent
	Acres	Percent		Acres	Percent
Allegheny loam, 2 to 6 percent slopes	1, 072	0. 3	Linker loam, 6 to 12 percent slopes	647	0. 2
Allegheny loam, 6 to 12 percent slopes	704	. 2	Melvin silt loam	3, 212	. 9
Allegheny stony loam, 12 to 20 percent slopes	748	. 2	Newark silt loam	6, 367	1. 8
Baxter cherty silt loam, 6 to 12 percent slopes	5, 482	1. 5	Nicholson silt loam, 0 to 2 percent slopes	1, 632	. 5
Baxter cherty silt loam, 12 to 20 percent slopes	2, 913	. 8	Nicholson silt loam, 2 to 6 percent slopes	5, 427	1. 5
Baxter cherty silty clay loam, 6 to 12 percent slopes, severely eroded	1, 260	. 4	Nicholson silt loam, 6 to 12 percent slopes	386	. 1
Bonnie silt loam	945	. 3	Nolin silt loam	13, 811	3. 8
Clifty gravelly silt loam	368	. 1	Pembroke silt loam, 0 to 2 percent slopes	9, 551	2. 7
Colbert silt loam, 6 to 12 percent slopes	1, 890	. 5	Pembroke silt loam, 2 to 6 percent slopes	62, 417	17. 3
Colbert silty clay, 6 to 12 percent slopes, severely eroded	721	. 2	Pembroke silt loam, 6 to 12 percent slopes	11, 716	3. 2
Crider silt loam, 0 to 2 percent slopes	1, 381	. 4	Pembroke silty clay loam, 6 to 12 percent slopes, severely eroded	1, 836	. 5
Crider silt loam, 2 to 6 percent slopes	12, 413	3. 5	Pickwick silt loam, 2 to 6 percent slopes	5, 174	1. 4
Crider silt loam, 6 to 12 percent slopes	2, 126	. 6	Pickwick silt loam, 6 to 12 percent slopes	4, 980	1. 4
Cuba silt loam	1, 597	. 5	Pickwick silty clay loam, 6 to 12 percent slopes, severely eroded	930	. 3
Cumberland silt loam, 2 to 6 percent slopes	1, 331	. 4	Robertsville silt loam	1, 235	. 4
Cumberland silt loam, 6 to 12 percent slopes	1, 322	. 4	Rock outcrop-Fredonia-Colbert complex	2, 683	. 7
Cumberland silty clay loam, 6 to 12 percent slopes, severely eroded	332	. 1	Sadler silt loam, 0 to 2 percent slopes	3, 432	1. 0
Dunning silty clay loam	2, 172	. 6	Sadler silt loam, 2 to 6 percent slopes	9, 425	2. 6
Elk silt loam, 0 to 2 percent slopes	1, 419	. 4	Steff silt loam	497	. 1
Elk silt loam, 2 to 6 percent slopes	5, 273	1. 5	Talbott silt loam, 2 to 6 percent slopes	8, 283	2. 3
Elk silt loam, 6 to 12 percent slopes	877	. 2	Talbott silt loam, 6 to 12 percent slopes	19, 894	5. 5
Epley silt loam, 2 to 6 percent slopes	7, 140	2. 0	Talbott silt loam, 12 to 20 percent slopes	1, 606	. 4
Epley silt loam, 6 to 12 percent slopes	1, 213	. 3	Talbott silty clay, 6 to 20 percent slopes, severely eroded	4, 389	1. 2
Fredonia rocky silty clay loam, 2 to 12 percent slopes	9, 260	2. 6	Talbott-Colbert rocky silt loams, 2 to 20 percent slopes	18, 188	5. 0
Frondorf silt loam, 6 to 12 percent slopes	10, 905	3. 0	Talbott-Colbert rocky silt loams, 20 to 50 percent slopes	15, 155	4. 2
Frondorf silt loam, 12 to 20 percent slopes	4, 355	1. 2	Wellston silt loam, 2 to 6 percent slopes	905	. 3
Frondorf stony complex, 12 to 50 percent slopes	20, 633	5. 8	Wellston silt loam, 6 to 12 percent slopes	6, 138	1. 7
Gullied land	303	. 1	Zanesville silt loam, 2 to 6 percent slopes	23, 689	6. 6
Hartsells loam, 6 to 12 percent slopes	579	. 2	Zanesville silt loam, 6 to 12 percent slopes	4, 909	1. 4
Johnsburg silt loam	1, 156	. 3	Lakes	471	. 1
Karnak silty clay	1, 094	. 3	Rock quarries	71	(1)
Lawrence silt loam	2, 860	. 8			
Lindside silt loam	5, 081	1. 4			
Linker loam, 2 to 6 percent slopes	149	(1)	Total	360, 130	100. 0

[1] Less than 0.05 percent.

B1t—8 to 11 inches, yellowish-brown (10YR 5/6) loam; weak, very fine, subangular blocky structure; friable; common roots; common clay films; medium acid; clear, smooth boundary.

B21t—11 to 22 inches, brown (7.5YR 4/4) clay loam; weak, fine, subangular blocky structure; friable; few roots; common clay films; very strongly acid; clear, smooth boundary.

B22t—22 to 30 inches, yellowish-brown (10YR 5/4) clay loam; many, medium, distinct mottles of brown (7.5YR 4/4); moderate, fine, subangular blocky structure; firm; many thick clay films; very strongly acid; clear, smooth boundary.

B23t—30 to 40 inches, mottled brown (7.5YR 4/4), red (2.5YR 4/8), and light yellowish-brown (10YR 6/4) clay loam; moderate, medium, subangular blocky structure; firm; many thick clay films; very strongly acid; clear, smooth boundary.

C—40 to 50 inches, mottled red (2.5YR 4/8), brownish-yellow (10YR 6/8), and brown (7.5YR 4/4) sandy clay; weak, coarse, angular blocky structure; firm; very strongly acid.

The solum ranges from 30 to 40 inches in thickness, and depth to bedrock is 40 inches or more. The profile is strongly acid or very strongly acid throughout, except where limed.

The Ap horizon is brown (10YR 4/3 or 5/3), and the B horizon ranges from brown (7.5YR 4/4) to light yellowish brown (10YR 6/4). The B2t horizon is clay loam or sandy clay loam, and the C horizon is sandy clay or sandy clay loam. In some places the A and B horizons are as much as 10 percent coarse fragments and gravel and the C horizon is as much as 35 percent.

Allegheny soils are near Pembroke, Crider, Pickwick, and Linker soils. They have a thinner solum than Pembroke, Crider, or Pickwick soils and have a higher content of sand in the subsoil and yellower hues in the lower part of the B horizon. They are coarser textured in the lower part of the B horizon than Pembroke and Crider soils. They are deeper over bedrock than Linker soils.

Allegheny loam, 2 to 6 percent slopes (AlB).—This soil is on moderately broad, high terraces. Areas range from 3 to 20 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping were small areas of Crider and Pembroke soils and a few small areas that are approximately 15 percent coarse fragments in the lower part of the B horizon.

This Allegheny soil is suited to most of the row crops and hay and pasture plants commonly grown in the county. Erosion is a hazard in cultivated areas, and soil-conserving practices therefore are needed to slow runoff and reduce erosion. (Capability unit IIe-4; woodland group 2o1)

Allegheny loam, 6 to 12 percent slopes (AlC).—This soil is on narrow ridges, side slopes, and foot slopes, gen-

erally below more gently sloping soils. Areas are long and narrow and range from 3 to 7 acres in size.

Included with this soil in mapping were a few small areas of Linker and Pembroke soils. Also included were a few small areas of a soil that is less than 40 inches deep over bedrock and has a surface layer of cobbly fine sandy loam and a subsoil that is 15 percent coarse fragments.

This Allegheny soil is suited to most row crops and hay and pasture plants commonly grown in the county. Erosion is a severe hazard. Where row crops are grown, soil-conserving practices are needed to slow runoff and reduce erosion. (Capability unit IIIe-5; woodland group 2o1)

Allegheny stony loam, 12 to 20 percent slopes (AsD).—This soil is on uplands and foot slopes. Areas are small and irregular in shape and range from 2 to 5 acres in size. This soil has a profile similar to the one described as representative of the series, but the surface layer is stony and is 3 to 5 inches thick.

Included with this soil in mapping were a few small areas of Linker soils and a few small areas of a soil that has a surface layer of cobbly fine sandy loam and a subsoil that is 15 percent coarse fragments.

This Allegheny soil is not suited to row crops, but it is suitable for pasture and trees. Erosion is a severe hazard in cultivated areas. Management therefore is needed to slow runoff and reduce erosion. (Capability unit VIs-1; woodland group 2o1)

Baxter Series

The Baxter series consists of deep, well-drained soils on uplands. These soils formed in red clayey residuum derived from cherty limestone. They are on the tops and sides of ridges. Slopes range from 6 to 20 percent.

In a representative profile the surface layer is brown cherty silt loam about 9 inches thick. The subsoil extends to a depth of 75 inches. It is strong-brown cherty silty clay loam in the upper 7 inches, red cherty silty clay and cherty clay in the next 32 inches, and mottled red, strong-brown, dark-red, and light-gray cherty clay in the lower part. The substratum to a depth of 100 inches is mottled red, strong-brown, light-gray, and dark-red cherty clay.

Baxter soils have a deep root zone and are moderately permeable. They are generally strongly acid or very strongly acid, but the surface layer is less acid where limed.

The wider ridgetops are used for row crops, and the steeper slopes are used mostly for hay and pasture and in some places for trees.

Representative profile of Baxter cherty silt loam, 6 to 12 percent slopes, on the north side of State Highway 102 about 1 mile east of Keysburg, approximately 10 miles southwest of Russellville and 0.75 mile north of the Tennessee-Kentucky State line:

Ap—0 to 9 inches, brown (10YR 4/3) cherty silt loam; weak, fine, granular structure; very friable; many roots; 20 percent chert fragments; medium acid; clear, smooth boundary.

B1t—9 to 16 inches, strong-brown (7.5YR 5/6) cherty silty clay loam; moderate, fine and medium, subangular blocky structure; friable; many roots; common thin clay films; 15 percent chert fragments; strongly acid; gradual, smooth boundary.

B21t—16 to 32 inches, red (2.5YR 4/6) cherty silty clay grading with depth to cherty clay; moderate, medium, angular blocky structure; very firm, sticky and plastic; common roots; discontinuous thin clay films on vertical and horizontal ped faces; 30 percent chert fragments; strongly acid; gradual, smooth boundary.

B22t—32 to 48 inches, red (10R 4/6) cherty clay; common, medium, distinct mottles of strong brown, yellowish brown, and light olive brown; moderate, medium, angular blocky structure; very firm, sticky and plastic; few roots; common thin clay films; 30 percent chert fragments; very strongly acid; gradual, wavy boundary.

B3t—48 to 75 inches, mottled red (2.5YR 4/6), strong-brown (7.5YR 5/6), light-gray (10YR 7/2), and dark-red (10R 3/6) cherty clay; moderate, medium, angular blocky structure; very firm, sticky and plastic; few roots; common thin clay films; 40 percent chert fragments; very strongly acid; gradual, wavy boundary.

C—75 to 100 inches, mottled red (2.5YR 4/6), strong-brown (7.5YR 5/6), light-gray (10YR 7/2), and dark-red (10R 3/6) cherty clay; massive; very firm, very sticky and plastic; 40 percent chert fragments; very strongly acid.

The solum ranges from 60 to 120 inches or more in thickness, and depth to limestone bedrock is more than 6 feet. The profile ranges from strongly acid to very strongly acid, but the surface layer is less acid where limed. Content of chert fragments ranges from 15 to 35 percent in the Ap, B1, and B2 horizons and from 20 to 50 percent in the B3 and C horizons.

The Ap horizon is generally brown (10YR 4/3) or dark grayish brown (10YR 4/2), but in severely eroded areas it ranges from strong-brown (7.5YR 5/6) to reddish-brown (5YR 4/4) and is cherty silty clay loam.

The B1 horizon ranges from reddish brown (5YR 4/4) to strong brown (7.5YR 5/6). The B2 horizon ranges from yellowish red (5YR 5/6) to red (10R 4/6) and from cherty silty clay loam to cherty clay. The B3 and C horizons are mottled in hues of red, brown, and gray.

Baxter soils are near Talbott, Pembroke, and Nicholson soils. They have a thicker solum and are deeper over bedrock than Talbott soils. They are more clayey in the subsoil than Pembroke soils, and they are cherty. They are better drained than Nicholson soils and do not have a fragipan.

Baxter cherty silt loam, 6 to 12 percent slopes (BaC).—This soil is on narrow ridgetops and upper sides of ridges. Karst topography is common. Areas are generally long and narrow and range from about 5 to 30 acres in size. The profile of this soil is the one described as representative of the series.

Included with this soil in mapping were some areas of a soil that is similar to this Baxter soil, but the plow layer is dark brown. Also included were a few small areas where slopes are less than 6 percent.

This Baxter soil is suited to most of the row crops and hay and pasture plants commonly grown in the county. It is somewhat difficult to till because chert fragments are throughout the profile. Erosion is a severe hazard. Where row crops are grown, soil-conserving practices are needed to slow runoff and reduce erosion. (Capability unit IIIe-2; woodland group 2o1)

Baxter cherty silt loam, 12 to 20 percent slopes (BaD).—This soil is on sides of ridges below the more gently sloping soils on ridgetops. Areas range from 5 to 50 acres in size.

Included with this soil in mapping were small areas of Talbott soils and some areas of Baxter soils that have slopes of more than 20 percent.

This soil is suited to most of the row crops and hay and pasture plants commonly grown in the county. It is difficult to till because chert fragments are numerous and slopes are steep. Row crops should be grown only occasionally because the hazard of erosion is very severe in cultivated areas. (Capability unit IVe-1; woodland group 2o1)

Baxter cherty silty clay loam, 6 to 12 percent slopes, severely eroded (BbC3).—This soil is on narrow ridgetops and sides of ridges. Slopes are mainly 9 to 12 percent. Areas are generally long and narrow and range from about 3 to 15 acres in size. This soil has a profile similar to the one described as representative of the series, but erosion has made the plow layer redder and finer textured.

Included with this soil in mapping were a few areas where the surface layer is cherty silt loam and a few small areas of severely eroded Pembroke soils.

This Baxter soil is suited to most row crops and hay and pasture plants commonly grown in the county. It is better suited to hay and pasture than to row crops. Seedbed preparation is difficult because the surface layer is clayey and cherty. The content of organic matter is very low. Erosion is a very severe hazard in cultivated areas. Soil-conserving practices therefore are needed to slow runoff and reduce erosion. (Capability unit IVe-6; woodland group 3o1)

Bonnie Series

The Bonnie series consists of deep, poorly drained soils on flood plains. These soils formed in alluvium washed from soils derived from acid sandstone, siltstone, shale, and, to a minor extent, limestone.

In a representative profile the surface layer is brown silt loam about 8 inches thick. The subsoil extends to a depth of about 33 inches. It is light brownish-gray silt loam mottled with brown and dark yellowish brown. Small, dark concretions are common. The substratum to a depth of 67 inches is gray light silty clay loam that has many brown mottles.

Bonnie soils are slowly permeable and have slow or ponded runoff. They are generally strongly acid, but the surface layer is less acid where limed.

Some areas of these soils are used for crops, hay, or pasture. Many are wooded.

Representative profile of Bonnie silt loam, 50 feet west of private road, 0.8 mile south of State Highway 107, and about 5.5 miles northwest of Lewisburg:

Ap—0 to 8 inches, brown (10YR 4/3) silt loam; weak, fine, granular structure; very friable; few small quartz pebbles; neutral; clear, smooth boundary.

Bg—8 to 33 inches, light brownish-gray (10YR 6/2) silt loam; many, medium, distinct, brown (10YR 5/3) mottles and few, distinct, dark yellowish-brown (10YR 4/4) mottles; weak, fine and medium, granular structure; friable; common iron and manganese concretions; strongly acid; diffuse boundary.

Cg—33 to 67 inches, gray (10YR 6/1) light silty clay loam; many, medium, distinct, brown (10YR 5/3 and 4/3) mottles; moderate, medium, subangular blocky structure; friable to firm; strongly acid.

The solum ranges from 24 to 36 inches in thickness. The profile is generally strongly acid to very strongly acid throughout, but the surface layer is less acid where limed.

The Ap horizon is brown (10YR 4/3), dark grayish brown (10YR 4/2), or light brownish gray (10YR 6/2). The B and C horizons range from gray (10YR 6/1) to light gray (2.5Y 7/2) mottled with brown, dark yellowish brown, and yellowish brown. The C horizon is generally gray (10YR 6/1) and has many prominent mottles that range from light gray to strong brown. The C horizon is silt loam or light silty clay loam and in some places has sandy strata.

The poorly drained Bonnie soils are near the moderately well drained Steff soils and the well drained Cuba soils.

Bonnie silt loam (Bo).—This soil is on flood plains and is nearly level or slightly depressed. Areas range from 2 to 20 acres in size.

Included with this soil in mapping were some small areas of Steff soils and a few areas where the surface layer is loam or fine sandy loam.

This Bonnie soil is subject to seasonal flooding, and depressions are sometimes ponded. Wetness delays seedbed preparation in spring.

This soil is suited to soybeans and corn. Grasses and legumes that tolerate wetness and overflow are used for pasture and hay. Adequate drainage allows earlier planting and a wider selection of plants. (Capability unit IIIw-1; woodland group 1w2)

Clifty Series

The Clifty series consists of nearly level, deep, well-drained gravelly soils on flood plains. These soils formed in alluvium derived from acid sandstone, siltstone, and shale.

In a representative profile the surface layer is brown gravelly silt loam about 10 inches thick. The subsoil is yellowish-brown gravelly fine sandy loam about 14 inches thick. The substratum to a depth of about 45 inches is brown gravelly silt loam.

Clifty soils have a deep root zone and are moderately rapidly permeable. They are strongly acid unless limed. They are subject to flooding of short duration during winter and spring.

The larger bottoms are suited to row crops, hay, and pasture. Other areas are mostly wooded.

Representative profile of Clifty gravelly silt loam on a flood plain southeast of State Highway 1038, 0.5 mile north of intersection with State Highway 103, about 5.5 miles north of Auburn:

Ap—0 to 10 inches, brown (10YR 4/3) gravelly silt loam; weak, fine, granular structure; very friable; 15 percent gravel, by volume; strongly acid; clear, smooth boundary.

B2—10 to 24 inches, yellowish-brown (10YR 5/4) gravelly fine sandy loam; weak, fine, granular structure; very friable; 20 percent gravel, by volume; strongly acid; gradual, wavy boundary.

C—24 to 45 inches, brown (10YR 4/3) gravelly silt loam; massive; very friable; 40 percent gravel, by volume; strongly acid.

The solum ranges from 2 to 3 feet in thickness, and the alluvial deposits range from 4 feet to about 12 feet in thickness. The profile is strongly acid or very strongly acid, unless the soil is limed. The A and B horizons range from 5 to 25 percent, by volume, gravel, and the C horizon ranges from 20 to 50 percent. Below a depth of 4 feet, the content of gravel is as much as 70 percent.

The A horizon is brown (10YR 4/3 or 5/3), and the B horizon ranges from dark yellowish brown (10YR 4/4) to yellowish brown (10YR 5/6). The B horizon is gravelly fine sandy loam, gravelly loam, or gravelly silt loam. The C horizon is brown (10YR 4/3 or 5/3) or yellowish brown (10YR 5/4). It is mainly gravelly silt loam or gravelly loam, but in places stratified layers of sand and gravel are below a depth of 40 inches.

Clifty soils are near Cuba and Steff soils, which are nongravelly in the upper 4 feet. They are better drained than Steff soils.

Clifty gravelly silt loam (Cf).—This nearly level soil is on narrow flood plains of small streams. Areas are generally long and narrow and range from 2 to 15 acres in size.

Included with this soil in mapping were small areas of Cuba and Steff soils and a few areas of a soil that is more than 50 percent gravel below a depth of 20 inches.

This Clifty soil is generally strongly acid. It has slow runoff and moderately rapid permeability, and it is subject to flooding during winter and spring.

Corn, soybeans, and hay and pasture plants that tolerate occasional flooding are better suited to this soil than other crops. (Capability unit IIs–1; woodland group 1o1)

Colbert Series

The Colbert series consists of moderately deep and deep, moderately well drained soils on ridgetops and sides of ridges. These soils formed in residuum weathered from argillaceous limestone and shaly limestone. Slopes range from 2 to 50 percent.

In a representative profile the surface layer is brown silt loam about 7 inches thick. The subsoil extends to a depth of about 39 inches. It is light yellowish-brown silty clay loam in the upper part, yellowish-brown clay that has many light brownish-gray and yellowish-red mottles in the middle part, and light brownish-gray clay that has many, distinct, strong-brown mottles in the lower part. The substratum to a depth of 51 inches or more is olive clay that has many brownish-yellow and gray mottles.

Colbert soils have a moderately deep root zone over very tight clay and are very slowly permeable. They are generally medium acid or strongly acid in the upper 2 feet, but the surface layer is less acid in places where it has been limed.

Most areas of Colbert soils are used for hay, pasture, or trees. A few areas are used for crops.

Representative profile of Colbert silt loam, 6 to 12 percent slopes, 50 feet southeast of gravel road, 0.75 mile southwest of intersection with U.S. Highway 431, 2.5 miles northwest of Lewisburg:

Ap—0 to 7 inches, brown (10YR 5/3) silt loam; weak, fine, granular structure; friable; slightly acid; clear, smooth boundary.

B1t—7 to 11 inches, light yellowish-brown (10YR 6/4) silty clay loam; moderate, medium, subangular blocky structure; firm, sticky and plastic; strongly acid; clear, smooth boundary.

B2t—11 to 27 inches, yellowish-brown (10YR 5/6) clay; many, medium, distinct mottles of light brownish gray (10YR 6/2) and yellowish red (5YR 4/6); strong, medium, blocky structure; common clay films; very firm, very sticky and very plastic; strongly acid; gradual, smooth boundary.

B3t—27 to 39 inches, light brownish-gray (10YR 6/2) clay; many distinct mottles of strong brown (7.5YR 5/6); moderate, medium, subangular blocky structure; very firm, plastic; 15 percent small chert fragments; few black concretions; medium acid.

C—39 to 51 inches +, olive (5Y 5/3) clay; many, medium, prominent mottles of brownish yellow (10YR 6/6) and gray (5Y 5/1); massive; very firm, very sticky and plastic; 10 percent small chert fragments; medium acid.

The solum ranges from 2 to 5 feet in thickness, and depth to bedrock ranges from 2½ to 7 feet. The A and B horizons range from slightly acid to strongly acid, and the C horizon ranges from neutral to medium acid. In most years during dry periods the soil cracks. The cracks are as much as ½ inch wide, 12 inches long, and 20 inches deep.

The Ap horizon ranges from dark grayish brown (10YR 4/2) to yellowish brown (10YR 5/4). It is generally silt loam or silty clay loam but ranges to silty clay in severely eroded areas.

The B1 horizon ranges from dark yellowish brown (10YR 4/4) to brownish yellow (10YR 6/6). It is silty clay loam or silty clay. The B2 horizon ranges from dark yellowish brown (10YR 4/4) to brownish yellow (10YR 6/8). The B3 and C horizons have hues of 10YR to 5Y, values of 4 to 7, and chromas of 1 to 6. These horizons have many distinct or prominent mottles within this color range. Limestone fragments less than 3 inches in diameter make up as much as 5 percent of the C horizon.

Colbert soils are near Talbott and Fredonia soils. They have yellower hues than Talbott and Fredonia soils, have larger cracks during dry periods, and are more poorly drained.

Colbert silt loam, 6 to 12 percent slopes (CoC).—This soil is on narrow ridgetops, sides of ridges, and benches. Areas range from 2 to 12 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping were a few small areas of Talbott soils; small areas of rock outcrops and a shallow, clayey soil between the rocks; and a few areas where slopes are less than 6 percent.

This Colbert soil is commonly medium acid to strongly acid in the upper 2 feet. It is poorly suited to tilled crops. It is better suited to hay, pasture, and trees. Erosion is a serious hazard in cultivated areas, and soil-conserving practices therefore are needed to slow runoff and reduce erosion. (Capability unit IVe–4; woodland group 3c1)

Colbert silty clay, 6 to 12 percent slopes, severely eroded (CpC3).—This soil is generally on the lower reaches of side slopes, on knolls, and to a lesser extent on benches of rough, steep land. Areas range from 2 to 10 acres in size. This soil has a profile similar to the one described as representative of the series, but the plow layer is yellowish-brown silty clay. Most or all of the original surface layer has been removed by erosion, and shallow gullies have formed in places.

Included with this soil in mapping were small areas of Talbott soils, small areas of uneroded Colbert soils, and areas of Colbert soils that have slopes of more than 12 percent.

This Colbert soil is normally medium or strongly acid in the upper 2 feet. It has very low organic-matter content and is poorly suited to crops. It is difficult to till because the clay content is high in the surface layer.

This soil is not suited to cultivated crops because tilth is poor and the erosion hazard is severe. It is better suited to hay, pasture, or trees than to other uses. (Capability unit VIe–2; woodland group 4c1)

Crider Series

The Crider series consists of nearly level to sloping, deep, well-drained soils on uplands. The upper 20 to 40 inches formed in loess, and the lower part formed in limestone residuum or old alluvium. A few areas have karst topography.

In a representative profile the surface layer is brown silt loam about 7 inches thick. The subsoil extends to a depth of 76 inches or more. The upper 37 inches is brown and yellowish-red silt loam. The lower part is dark-red silty clay loam.

Crider soils have a deep root zone and are moderately permeable. They are generally medium acid to very strongly acid, but the surface layer is less acid where limed.

These soils are used extensively for crops. A small acreage is used for pasture and hay.

Representative profile of Crider silt loam, 0 to 2 percent slopes, 50 feet southwest of State Highway 1039, about 1.1 miles southeast of intersection with U.S. Highway 68, near the city limits of Auburn:

Ap—0 to 7 inches, brown (10YR 4/3) silt loam; weak, fine, granular structure; very friable; medium acid; clear, smooth boundary.

B1t—7 to 12 inches, brown (7.5YR 4/4) silt loam; weak, fine, subangular blocky structure; friable; few clay films; medium acid; gradual, smooth boundary.

B21t—12 to 30 inches, brown (7.5YR 4/4) silt loam; moderate, medium, subangular blocky structure; friable; common clay films; few, small, black concretions; very strongly acid; gradual, smooth boundary.

B22t—30 to 44 inches, yellowish-red (5YR 4/6) heavy silt loam; moderate, medium, subangular blocky structure; friable; common clay films; few, small, black concretions; silt coatings on some peds in lower part; very strongly acid; gradual, smooth boundary.

IIB23t—44 to 76 inches +, dark-red (2.5YR 3/6) silty clay loam; moderate, medium, angular and subangular blocky structure; firm; common clay films; 5 percent pale-brown silt pockets, by volume; pale-brown silt coatings on some peds; common concretions; very strongly acid.

The solum ranges from 60 to 100 inches in thickness, and depth to bedrock ranges from 60 to 140 inches. The profile is generally medium acid to very strongly acid, but the surface layer is less acid where limed.

The Ap horizon is generally brown (10YR 4/3 or 5/3), but in some places it is dark grayish brown (10YR 4/2). The B1t and B21t horizons range from brown (7.5YR 4/4) to yellowish red (5YR 4/6). The B22t horizon is reddish-brown (5YR 4/4) or yellowish-red (5YR 4/6) silt loam. The IIB horizon is dark red (2.5YR 3/6 or 10R 3/6).

Crider soils are near Pembroke, Pickwick, and Nicholson soils. They are more silty and less red in the upper part of the B horizon than Pembroke and Pickwick soils. They are lighter colored in the Ap horizon than Pembroke soils. They are better drained than Nicholson soils.

Crider silt loam, 0 to 2 percent slopes (CrA).—This soil is on broad ridgetops. Areas range from 2 to 40 acres in size. This soil has the profile described as representative of the series. Included in mapping were small areas of Pembroke and Nicholson soils.

This Crider soil is easy to till and is not subject to erosion. It is suited to all of the row crops and hay and pasture plants commonly grown in the county. It is well suited to tobacco and alfalfa. (Capability unit I-3; woodland group 1o2)

Crider silt loam, 2 to 6 percent slopes (CrB).—This soil is on broad ridgetops. Areas range from 2 to 35 acres in size. Included in mapping were small areas of Pembroke and Nicholson soils.

This Crider soil is suited to all of the row crops and hay and pasture plants commonly grown in the county. It is well suited to tobacco and alfalfa. It is easy to till, but is subject to erosion. Soil-conserving practices therefore are needed to slow runoff and reduce erosion. (Capability unit IIe-1; woodland group 1o2)

Crider silt loam, 6 to 12 percent slopes (CrC).—This soil is on long, narrow ridgetops and on side slopes below more nearly level soils. Areas range from 5 to 20 acres in size. A few areas have karst topography. Included in mapping were a few areas of Pembroke soils and eroded Crider soils.

This Crider soil is suited to most of the row crops and hay and pasture plants commonly grown in the county. It is easy to till, but the erosion hazard is severe. Soil-conserving practices therefore are needed to slow runoff and reduce erosion. (Capability unit IIIe-1; woodland group 1o2)

Cuba Series

The Cuba series consists of nearly level, deep, well-drained soils on flood plains adjacent to major streams and their tributaries. These soils formed in silty, acid alluvium.

In a representative profile the surface layer is brown silt loam about 9 inches thick. The subsoil is yellowish-brown and dark yellowish-brown silt loam that extends to a depth of 44 inches. The substratum to a depth of 70 inches or more is brown and grayish-brown, stratified silt loam, loam, and fine sandy loam.

Cuba soils have a deep root zone and are moderately permeable. They are generally strongly acid or very strongly acid throughout, but the surface layer is less acid where limed. Occasional flooding occurs in spring and during the growing season.

Most areas of Cuba soils are used for crops. A small acreage is used for hay or pasture.

Representative profile of Cuba silt loam, in a field 15 feet north of Clifty Creek along a gravel road, 0.9 mile south of intersection with State Highway 107, 5.5 miles northwest of Lewisburg:

Ap—0 to 9 inches, brown (10YR 4/3) silt loam; weak, fine, granular structure; very friable; slightly acid; abrupt, smooth boundary.

B21—9 to 24 inches, yellowish-brown (10YR 5/4) silt loam; weak, fine, granular and subangular blocky structure; friable; very strongly acid; clear, smooth boundary.

B22—24 to 44 inches, dark yellowish-brown (10YR 4/4) silt loam and thin strata of yellowish brown (10YR 5/6); weak, fine, granular and subangular blocky structure; friable; strongly acid.

IIC—44 to 70 inches +, brown (10YR 4/3) and grayish-brown (10YR 5/2), stratified silt loam, loam, and fine sandy loam; massive; friable; strongly acid.

The solum ranges from 2 to 6 feet in thickness and is underlain by stratified material. The profile is generally strongly acid or very strongly acid throughout, but the sur-

face layer is neutral to medium acid in places where it has been limed.

The Ap horizon ranges from dark grayish brown (10YR 4/2) to brown (10YR 5/3). The B and C horizons range from brown (10YR 4/3) to brownish yellow (10YR 6/6). Some profiles have mottles below a depth of 30 inches.

The well drained Cuba soils are near the moderately well drained Steff soils and the poorly drained Bonnie soils. All three soils in this drainage sequence formed in acid alluvium.

Cuba silt loam (Cu).—This nearly level soil is on narrow and broad flood plains. Areas range from 2 to 35 acres in size. Included in mapping were some areas of Steff and Clifty soils.

This soil is generally strongly acid or very strongly acid throughout, but the surface layer is less acid in places where it has been limed. Crops grow well on this soil, but they can be damaged by occasional flooding in spring and during the growing season. The soil is easy to till.

This soil is suited to most of the row crops and hay and pasture plants commonly grown in the county. (Capability unit I–1; woodland group 1o1)

Cumberland Series

The Cumberland series consists of deep, well-drained soils on the tops and sides of ridges. These soils formed in old alluvium that is commonly underlain by material weathered from limestone. Slopes range from 2 to 12 percent.

In a representative profile the surface layer is dark reddish-brown silt loam about 6 inches thick. The subsoil extends to a depth of 60 inches or more. It is dark-red silty clay loam in the upper part and dusky-red and dark-red clay in the lower part.

Cumberland soils have a deep root zone and are moderately permeable. They are generally strongly acid to very strongly acid throughout, but the surface layer ranges from medium acid to slightly alkaline in places where it has been limed.

Cumberland soils are used mostly for crops. A small acreage is used for pasture and hay. These soils are well suited to alfalfa.

Representative profile of Cumberland silt loam, 2 to 6 percent slopes, in a field of alfalfa and orchardgrass along State Highway 765, about 2.2 miles south of intersection with State Highway 664, about 1.8 miles east of Schochoh:

Ap—0 to 6 inches, dark reddish-brown (5YR 3/4) silt loam; moderate, medium, granular structure; friable; many fine roots; slightly alkaline; abrupt, smooth boundary.

B1t—6 to 11 inches, dark-red (2.5YR 3/6) silty clay loam; moderate, medium, subangular blocky structure; firm; common fine roots; common clay films; slightly alkaline; clear, smooth boundary.

B21t—11 to 26 inches, dark-red (10R 3/6) clay; moderate, fine and medium, subangular blocky structure; firm; common fine roots; common clay films; strongly acid; diffuse, smooth boundary.

B22t—26 to 60 inches +, dusky-red (10R 3/4) clay; moderate, medium, subangular blocky structure; firm; few roots; thin continuous clay films; very strongly acid.

The solum ranges from 5 to 7 feet or more in thickness, and depth to bedrock ranges from 5 to 10 feet or more. Chert or gravel makes up 0 to 15 percent, by volume, of the profile. The profile is generally strongly acid to very strongly acid throughout, but the surface layer and upper part of the subsoil are medium acid to slightly alkaline in places where the soil has been limed.

The Ap horizon is dark brown (7.5YR 3/2) or dark reddish brown (5YR 3/2, 3/3, or 3/4). It is generally silt loam, but in severely eroded areas it is silty clay loam. The B1 horizon is dark reddish brown (5YR 3/4) or dark red (2.5YR 3/6). The B2 horizon ranges from dark reddish brown (2.5YR 3/4) to dark red (10R 3/6).

Cumberland soils are near Pembroke, Crider, and Baxter soils. They have a redder and more clayey B horizon than Pembroke soils. They are more clayey in the B horizon than Crider soils. They contain less chert than Baxter soils, which have a brown or dark grayish-brown layer.

Cumberland silt loam, 2 to 6 percent slopes (CvB).—This soil is on broad ridgetops. Areas range from 2 to 30 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping were small areas of Pembroke and Crider soils and small areas of eroded soils that are less friable and have subsoil material mixed into the surface layer.

This Cumberland soil is suited to all of the row crops and hay and pasture plants commonly grown in the county. It is easy to till. Erosion is a moderate hazard in cultivated areas. Soil-conserving practices therefore are needed to slow runoff and reduce erosion. (Capability unit IIe–1; woodland group 2c1)

Cumberland silt loam, 6 to 12 percent slopes (CvC).—This soil is on narrow ridges and sides of ridges below gently sloping soils. Areas are long and narrow and range from 2 to 10 acres in size.

Included with this soil in mapping were a few small areas of eroded soils and a few areas of soils that are more than 15 percent chert fragments.

This soil is suited to most of the row crops and hay and pasture plants commonly grown in the county. Erosion is a severe hazard in cultivated areas. Soil-conserving practices therefore are needed to slow runoff and reduce erosion. (Capability unit IIIe–1; woodland group 2c1)

Cumberland silty clay loam, 6 to 12 percent slopes, severely eroded (CwC3).—This soil is on narrow ridgetops and sides of ridges below more gently sloping soils. Areas are generally long and narrow but in places are irregularly shaped. This soil has a profile similar to the one described as representative of the series, but the surface layer is redder and finer textured as a result of erosion. Shallow gullies are common in places.

Included with this soil in mapping were some small areas of a soil that is less eroded than this Cumberland soil and has a surface layer of silt loam and a few small areas where slopes are more than 12 percent.

Because the surface layer is silty clay loam, the soil is somewhat difficult to till. It is very low in content of organic matter.

This soil is suited to all of the crops commonly grown in the county. It is suited to row crops only occasionally because the erosion hazard is very severe. It is better suited to pasture and hay crops than to other uses. (Capability unit IVe–5; woodland group 3c1)

Dunning Series

The Dunning series consists of nearly level, deep, very poorly drained soils on flood plains and in upland depressions. These soils formed in clayey alluvium.

In a representative profile the surface layer is very dark grayish-brown silty clay loam about 8 inches thick that overlies 4 inches of very dark brown silty clay loam. The subsoil is dark-gray silty clay that has many mottles of olive brown and extends to a depth of 30 inches. The substratum to a depth of 52 inches or more is dark-gray clay that has many mottles in shades of brown.

Dunning soils have high organic-matter content and are slowly permeable. The root zone is deep, but the water table is seasonally high. These soils are subject to occasional flooding.

Most areas of Dunning soils are used for pasture and hay. Some row crops are grown in adequately drained areas.

Representative profile of Dunning silty clay loam, about 0.5 mile west of bridge where State Highway 73 crosses Black Lick Creek, 6 miles north of South Union:

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) silty clay loam; weak, fine, subangular blocky structure; moderately firm, sticky; few dark concretions; mildly alkaline; clear, smooth boundary.

A1—8 to 12 inches, very dark brown (10YR 2/2) silty clay loam; few, fine, grayish-brown (2.5Y 5/2) mottles; moderate, fine, angular blocky structure; firm, sticky; few, medium, dark concretions; mildly alkaline; gradual, smooth boundary.

Bg—12 to 30 inches, dark-gray (5Y 4/1) silty clay; many, fine, distinct, olive-brown (2.5Y 4/4) mottles; massive; firm, sticky and plastic; neutral; gradual, smooth boundary.

Cg—30 to 52 inches +, dark-gray (5Y 4/1) clay; many, coarse, distinct, light olive-brown (2.5Y 5/6) and light yellowish-brown (2.5Y 6/4) mottles; massive; firm, plastic; neutral.

The solum ranges from 30 to 50 inches in thickness, and depth to bedrock is more than 40 inches. The profile ranges from slightly acid to mildly alkaline throughout.

The Ap and A1 horizons range from very dark grayish brown (10YR 3/2) to black (10YR 2/1). The B and C horizons are mainly dark gray (5Y 4/1 or N 4/0) and gray (5Y 5/1 or N 5/0), and they are mottled with olive brown, light olive brown, or light yellowish brown. They are silty clay or clay.

Dunning soils are near Karnak and Melvin soils. They have a darker surface layer than Karnak soils and do not crack so much when dry. They are darker colored and more clayey than Melvin soils.

Dunning silty clay loam (Du).—This nearly level soil is on flood plains or in upland depressions. The areas are irregularly shaped and range from 2 to 10 acres in size.

This soil is slightly acid to mildly alkaline throughout. The texture of the surface layer and the seasonal high water table make it somewhat difficult to till. Occasional flooding is a hazard. This soil is suited to soybeans and corn in drained areas. It is better suited to hay and pasture plants that tolerate wetness than to other uses. (Capability unit IIIw-3; woodland group 1w2)

Elk Series

The Elk series consists of deep, well-drained soils on stream terraces. These soils formed in old alluvium washed from soils that formed in residuum, mainly from limestone. Slopes range from 0 to 12 percent.

In a representative profile the surface layer is brown silt loam about 8 inches thick. The subsoil extends to a depth of about 48 inches. It is dark yellowish-brown heavy silt loam in the upper part, dark-brown light silty clay loam in the middle part, and yellowish-brown silt loam in the lower part. The underlying material to a depth of 60 inches or more is yellowish-brown gravelly loam that is 30 percent gravel.

Elk soils have a deep root zone and are moderately permeable. They are generally medium acid to strongly acid, but the surface layer is less acid where limed.

The gentle slopes are used mostly for crops. The steeper slopes are used mainly for pasture and hay. Small acreages are wooded.

Representative profile of Elk silt loam, 0 to 2 percent slopes, in a field on the southeast side of U.S. Highway 79 and on the west side of Dry Fork Creek, about 5.1 miles southwest of Russellville:

Ap—0 to 8 inches, brown (10YR 4/3) silt loam; weak, fine, granular structure; very friable; medium acid; clear, smooth boundary.

B21t—8 to 13 inches, dark yellowish-brown (10YR 4/4) heavy silt loam; weak, medium and fine, subangular blocky structure; friable, slightly sticky and slightly plastic; thin patchy clay films; few dark-brown concretions: common fine roots; medium acid; clear, smooth boundary.

B22t—13 to 27 inches, dark-brown (7.5YR 4/4) light silty clay loam; moderate, medium, subangular blocky structure; friable, slightly sticky and slightly plastic; common clay films; few, small, dark-brown concretions; strongly acid; clear, smooth boundary.

B23t—27 to 48 inches, yellowish-brown (10YR 5/4) silt loam; thin silt coatings of light brownish gray (10YR 6/2); moderate, medium, subangular blocky structure; friable; few clay films; 2 percent gravel; strongly acid; gradual, smooth boundary.

C—48 to 60 inches +, yellowish-brown (10YR 5/4) gravelly loam; common, medium, faint mottles of brown (7.5YR 4/4) and light brownish gray (2.5Y 6/2); weak, medium, subangular blocky structure parting to massive; friable; 30 percent gravel; very strongly acid.

The solum ranges from 36 to 54 inches in thickness, and depth to bedrock is more than 60 inches. The profile generally ranges from medium acid to very strongly acid throughout, but the surface layer is less acid where limed. In some places A and B horizons are 1 to 5 percent small gravel. The C horizon ranges from 0 to 35 percent gravel.

The Ap horizon is commonly brown (10YR 4/3), but ranges from dark grayish brown (10YR 4/2) to yellowish brown (10YR 5/4). The B and C horizons range from dark yellowish brown (10YR 4/4) to strong brown (7.5YR 5/6). The B horizon is silt loam or light silty clay loam.

Elk soils are near Nolin, Lindside, and Nicholson soils. In contrast with Nolin and Lindside soils, the Elk soils have clay accumulation in the subsoil. They are better drained than Nicholson soils, which have a fragipan.

Elk silt loam, 0 to 2 percent slopes (ElA).—This soil is on stream terraces. Areas range from 2 to 20 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping were a few small areas of Nicholson soils and a few areas of Elk soils that have a surface layer of fine sandy loam. Also included were a few areas of a soil that is similar to this Elk soil, but is more than 35 percent gravel in the C horizon.

This soil is subject to occasional flooding of short duration. It is easy to till and is suited to most of the row crops and hay and pasture plants commonly grown in the county. (Capability unit I–3; woodland group 2o1)

Elk silt loam, 2 to 6 percent slopes (ElB).—This soil is on stream terraces and has uniform slopes. Areas range from 2 to 20 acres in size.

Included with this soil in mapping were small areas of Nicholson soils and a few areas of a soil that is similar to this soil, but is more than 35 percent gravel in the C horizon.

In some areas this soil is subject to very infrequent flooding. It is easy to till and is suited to most of the row crops and hay and pasture plants commonly grown in the county. Erosion is a moderate hazard in cultivated areas. Soil-conserving practices therefore are needed to slow runoff and reduce erosion. (Capability unit IIe–1; woodland group 2o1)

Elk silt loam, 6 to 12 percent slopes (ElC).—This soil is on stream terraces. Areas are generally long, narrow, and concave and range from 2 to 15 acres in size.

Included with this soil in mapping were a few areas of a soil that is similar to this Elk soil but is 10 to 20 percent chert fragments in the surface layer. Also included were some areas of soils that have slopes of more than 12 percent and a few areas of a soil that is similar to this Elk soil but is more than 35 percent gravel in the C horizon.

This soil is suited to most of the row crops and hay and pasture plants commonly grown in the county. Erosion is a severe hazard in cultivated areas. Soil-conserving practices therefore are needed to slow runoff and reduce erosion. (Capability unit IIIe–1; woodland group 2o1)

Epley Series

The Epley series consists of deep, moderately well drained soils on ridgetops and in slight depressions of the uplands. These soils formed in 20 to 36 inches of silty material that is underlain by clayey residuum or old alluvium. Slopes range from 2 to 12 percent.

In a representative profile the surface layer is brown silt loam about 6 inches thick. The subsoil extends to a depth of 46 inches. It is yellowish-brown silt loam in the upper 18 inches and brown or strong-brown silty clay or clay mottled with brownish gray or gray in the lower part. The substratum to a depth of 64 inches or more is mottled strong-brown, yellowish-brown, and light-gray clay.

Epley soils have a moderately deep root zone overlying very firm silty clay or clay at a depth of about 2 to 2½ feet. They are slowly permeable.

These soils are used for crops, pasture, hay, and trees.

Representative profile of Epley silt loam, 2 to 6 percent slopes, along State Highway 1153, 0.1 mile north of intersection with State Highway 106, about 1.5 miles northeast of Lewisburg:

Ap—0 to 6 inches, brown (10YR 4/3) silt loam; moderate, fine and medium, granular structure; very friable; many fine roots; neutral; abrupt, smooth boundary.

B21t—6 to 19 inches, yellowish-brown (10YR 5/6) heavy silt loam; weak, fine and medium, subangular blocky structure; friable; common fine roots; common thin clay films; strongly acid; gradual, smooth boundary.

B22t—19 to 24 inches, yellowish-brown (10YR 5/6) heavy silt loam; common, medium, faint, strong-brown (7.5YR 5/6) and light brownish-gray (10YR 6/2) mottles; moderate, medium, subangular blocky structure; friable; common fine roots; common thin clay films; strongly acid; abrupt, smooth boundary.

IIB&A'—24 to 28 inches, brown (7.5YR 4/4) silty clay; many, medium, distinct, light brownish-gray (10YR 6/2) mottles; moderate, medium, prismatic structure parting to moderate, fine and medium, angular blocky; firm; A part is skeletons, mostly on all vertical faces of prisms, 1 millimeter to 4 millimeters thick, of pale-brown (10YR 6/3) silt, white (10YR 8/1) dry; few fine roots between prisms; many thin clay films on blocks; strongly acid; clear, smooth boundary.

IIB23t—28 to 37 inches, strong-brown (7.5YR 5/6) silty clay; many, medium, distinct, gray (10YR 6/1) mottles; moderate, medium, prismatic structure parting to moderate, medium, angular blocky; very firm; few fine roots between prisms; nearly continuous gray clay films on prisms; many, brown and gray, thin clay films on blocks; strongly acid; gradual, smooth boundary.

IIB3t—37 to 46 inches, mottled strong-brown (7.5YR 5/6) and gray (10YR 6/1) clay; weak, fine and medium, angular blocky structure; very firm; common thin clay films; medium acid; gradual, smooth boundary.

IIC—46 to 64 inches +, mottled strong-brown (7.5YR 5/6), yellowish-brown (10YR 5/4), and light-gray (10YR 7/2 and 6/1) clay; massive; very firm; slightly acid.

The solum ranges from 30 to 60 inches in thickness, and depth to bedrock ranges from 48 to 120 inches. The profile generally ranges from strongly acid to medium acid to a depth of about 3 feet and from medium acid to neutral below, but the surface layer is less acid where limed.

The Ap horizon ranges from dark grayish brown (2.5Y 4/2) to dark yellowish brown (10YR 4/4). The B2t horizon ranges from pale brown (10YR 6/3) to light olive brown (2.5Y 5/6), and in some places the B22t horizon is mottled with shades of brown and gray. It is silt loam or silty clay loam. The IIB horizon ranges from dark yellowish brown (10YR 4/4) to strong brown (7.5YR 5/8) and is mottled with shades of gray. In some places the lower part of the IIB horizon is mottled with shades of brown and gray or has a dominant color of gray. It is silty clay or clay. The IIC horizon has the same color and texture as the IIB horizon. Fragments of shale and limestone make up 0 to 50 percent of the profile below a depth of 48 inches.

Epley soils are near Talbott and Lawrence soils. They are better drained than Lawrence soils, which have a fragipan. They are not so well drained as Talbott soils and are less red and less clayey in the subsoil.

Epley silt loam, 2 to 6 percent slopes (EpB).—This soil is mostly on broad ridgetops and in broad, concave depressions. Areas range from 2 to 40 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping were small eroded areas and small areas of Epley soils that have slopes of less than 2 percent.

This Epley soil is generally strongly acid to a depth of about 3 feet, but the surface layer is less acid in places where it has been limed. The seasonal high water table delays planting of crops in spring.

This soil is suited to most of the row crops and hay and pasture plants commonly grown in the area. It is unsuitable for alfalfa. Erosion is a moderate hazard. Soil-conserving practices therefore are needed to reduce erosion in cultivated areas. (Capability unit IIe–2; woodland group 3w1)

Epley silt loam, 6 to 12 percent slopes (EpC).—This soil is on narrow ridgetops or on convex topography below the more gently sloping soils. Areas are generally long and narrow and range from 2 to 10 acres in size. Included in mapping were small areas of eroded Epley soils.

This Epley soil is generally strongly acid in the upper 3 feet unless limed. The seasonal high water table delays planting of crops in spring.

With the exception of alfalfa, most of the row crops and hay and pasture plants commonly grown in the area are suited to this soil. Erosion is a severe hazard and soil-conserving practices therefore are needed to slow runoff and reduce erosion. (Capability unit IIIe-3; woodland group 3w1)

Fredonia Series

The Fredonia series consists of moderately deep, well-drained soils on broad ridgetops and sides of ridges. These soils formed in residuum derived from massive gray limestone. Slopes are mainly 2 to 12 percent. In small areas where slopes are more than 12 percent these soils are mapped with Rock outcrop and Colbert soils.

In a representative profile the surface layer is dark-brown silty clay loam about 6 inches thick. The subsoil is dark-red silty clay or clay that extends to a depth of 32 inches. Light-gray, massive limestone is at a depth of 32 inches.

Fredonia soils have a moderately deep root zone and are moderately slowly permeable. They are generally medium acid to strongly acid, but the surface layer is less acid in places where it has been limed.

Most areas of these soils are used for hay and pasture. Some are wooded.

Representative profile of Fredonia silty clay loam in an area of Fredonia rocky silty clay loam, 2 to 12 percent slopes, on the north side of U.S. Highway 68, 6 miles east of Russellville:

Ap—0 to 6 inches, dark-brown (7.5YR 3/2) silty clay loam; moderate, fine, granular structure; very friable; many fine roots; neutral; abrupt, smooth boundary.

B21t—6 to 20 inches, dark-red (2.5YR 3/6) silty clay; moderate, fine and medium, subangular blocky structure; very firm; common fine roots; many thin clay films; strongly acid; gradual, smooth boundary.

B22t—20 to 32 inches, dark-red (10R 3/6) clay; moderate, fine and medium, angular blocky structure; very firm; few fine roots; many clay films; few, thin, black films; few, fine, black concretions; medium acid; abrupt, wavy boundary.

R—32 inches +, light-gray, massive limestone.

The solum ranges from 20 to 40 inches in thickness, and depth to bedrock ranges from 20 to 40 inches. The Ap and B21t horizons are generally medium acid to strongly acid, but the surface layer is less acid where limed. The B22t horizon ranges from medium acid to neutral. Content of chert fragments ranges from 0 to 5 percent.

The Ap horizon ranges from dark brown (7.5YR 3/2) to reddish brown (5YR 4/4). It is silt loam or silty clay loam. The B21t horizon is dark-red (2.5YR 3/6) or red (2.5YR 4/6) silty clay or heavy silty clay loam. The B22t horizon is dark-red (10R 3/6) or dusky-red (10R 3/4) silty clay or clay.

Fredonia soils are near Pembroke, Cumberland, and Crider soils, all of which have a solum that is underlain by bedrock at a depth of 60 inches or more. They are redder and more clayey in the B horizon than Pembroke and Crider soils.

Fredonia rocky silty clay loam, 2 to 12 percent slopes (FeC).—This soil is on broad ridgetops and sides of ridges. Areas range from 2 to 25 acres in size. Rock outcrop covers 2 to 10 percent of the surface area. Karst topography and sinkholes occur in places. Included in mapping were small areas of Pembroke and Cumberland soils.

In most areas this Fredonia soil is medium acid to strongly acid. It is suited to most of the hay and pasture plants commonly grown in the county. Cultivated crops are not generally grown because erosion is a severe hazard. Soil-conserving practices are needed to slow runoff and reduce erosion. (Capability unit VIs-1; woodland group 3x1)

Frondorf Series

The Frondorf series consists of moderately deep, well-drained soils on the tops and sides of ridges. These soils formed in a thin mantle of loess and in material weathered from sandstone, siltstone, and shale. Slopes range from 6 to 50 percent.

In a representative profile the surface layer is dark-brown silt loam about 7 inches thick. The subsoil is dark yellowish-brown silt loam and light silty clay loam that contains some coarse fragments. It extends to a depth of 25 inches. The substratum extends to a depth of 34 inches and is a mixture of yellowish-brown loam and sandstone fragments. Sandstone bedrock is at a depth of about 34 inches.

Frondorf soils have a moderately deep root zone and are moderately permeable. They are generally very strongly acid, but the surface layer is less acid in places where it has been limed.

Areas of Frondorf soils on ridgetops are used for crops, hay, and pasture. Most of the steeper slopes are pastured or wooded.

Representative profile of Frondorf silt loam, 6 to 12 percent slopes, east of a stone house, 0.4 mile east of State Highway 103 on a private drive, entrance of which is 1.3 miles southeast of Chandlers Chapel:

Ap—0 to 7 inches, dark-brown (10YR 4/3) silt loam; weak very fine, granular structure; friable; many roots; very strongly acid; abrupt, smooth boundary.

B1—7 to 14 inches, dark yellowish-brown (10YR 4/4) silt loam; weak, fine, subangular blocky structure; friable; common roots; 3 percent coarse fragments, 1 to 3 inches in diameter; very strongly acid; clear, smooth boundary.

IIB2t—14 to 25 inches, dark yellowish-brown (10YR 4/4) light silty clay loam; moderate, medium, subangular blocky structure; friable; few fine roots; few clay films; 5 percent coarse fragments, 1 to 3 inches in diameter; very strongly acid; gradual, wavy boundary.

IIC—25 to 34 inches, yellowish-brown (10YR 5/4) channery loam; massive; 50 percent coarse fragments, 1 to 10 inches in diameter; very strongly acid; clear, wavy boundary.

IIR—34 inches, fine-grained sandstone.

The solum ranges from 20 to 40 inches in thickness, and depth to sandstone, siltstone, or shale bedrock is 20 to 40 inches. The profile is very strongly acid or strongly acid unless limed. Content of coarse fragments in the solum

ranges from 0 to 50 percent but averages less than 35 percent. The content ranges from 15 to 75 percent below.

The Ap horizon ranges from dark grayish brown (10YR 4/2) to yellowish brown (10YR 5/4). The B horizon is dark yellowish-brown (10YR 4/4) or yellowish-brown (10YR 5/4 to 5/8) silt loam or silty clay loam or their channery analogues. It has weak or moderate, fine or medium, subangular or angular blocky structure. The IIC horizon ranges from yellowish-brown (10YR 5/4) to olive-brown (2.5Y 4/4) silt loam, silty clay loam, silty clay, clay, clay loam, loam, or sandy clay loam or their channery analogues. In some places a IIB3 horizon just above rock has the same color and texture as the C horizon.

Frondorf soils are near Wellston and Zanesville soils. They are shallower over bedrock than Wellston soils and have more coarse fragments in the subsoil. They are better drained than Zanesville soils, which have a fragipan.

Frondorf silt loam, 6 to 12 percent slopes (FrC).—This soil is on narrow ridgetops and the upper sides of broader ridges. Areas range from about 5 to 50 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping were small areas of Wellston, Hartsells, and Zanesville soils and small areas of eroded soils that have a dark yellowish-brown surface layer and common, shallow gullies and rills.

This Frondorf soil generally is very strongly acid and has low natural fertility. A good fertilization program is needed. The soil is droughty in places where the content of coarse fragments is high or where depth to rock is less than about 30 inches. It is easy to till.

This soil is suited to most of the cultivated crops and hay and pasture plants commonly grown in the county. Erosion is a severe hazard in cultivated areas. Soil-conserving practices are needed to slow runoff and reduce erosion. (Capability unit IIIe-6; woodland group 3o1)

Frondorf silt loam, 12 to 20 percent slopes (FrD).—This soil is on side slopes. Areas are irregularly shaped and range from about 4 to 30 acres in size. This soil has a profile similar to the one described as representative of the series, but the surface layer is about 5 or 6 inches thick.

Included with this soil in mapping were some small areas of Wellston soils and some areas of eroded soils that have a dark yellowish-brown surface layer and numerous shallow gullies.

This Frondorf soil generally is very strongly acid and has low natural fertility. Applications of lime and fertilizer are needed to maintain good plant growth. The soil is droughty in places where the content of coarse fragments is high or where rock is at a depth of less than about 30 inches. It is easy to till.

This soil is suited to most of the row crops and hay and pasture plants commonly grown in the county. It is not well suited to row crops because of the very severe hazard of erosion. It is used mostly for hay, pasture, or trees (fig. 6). (Capability unit IVe-2; woodland group 3o1)

Frondorf stony complex, 12 to 50 percent slopes (FsF).—The soils in this complex are on hillsides and narrow ridges and in narrow valleys. Areas range from about 50 acres to several hundred acres in size and are dissected by streams and drainageways. The Frondorf soils have a profile similar to the one described as representative of the series, but the surface layer is generally stony or channery and the subsoil contains more coarse fragments. Frondorf soils make up about 55 percent of this unit; rock outcrop and stony land about 20 percent; a shallow soil about 10 percent; and Allegheny soils, clayey soils, and alluvial soils, about 5 percent each.

Frondorf soils are on narrow ridges and hillsides. Rock outcrop or a cliff 10 to 15 feet high is near the top of many hillsides, and stony land is just below the cliff in many places. A shallow soil is near the tops of hills in places and near rock outcrop. Alluvial soils are in the narrow valleys.

Stoniness and slope make the soils of this mapping unit better suited to pasture plants and trees that tolerate droughtiness than to other uses. They are used mostly for trees, pasture, or wildlife habitat. (Capability unit VIIs-1; woodland group 3x2)

Gullied Land

Gullied land (Gu) consists of areas that have undergone such severe sheet erosion that the soil profile has generally been destroyed, except in narrow strips between gullies. Areas range from 1 to 10 acres in size. The gullies, which typically make up more than 50 percent of the area, are 1 to 5 feet deep and 1 to 10 feet wide. Several are eroded to bedrock. Slopes range from 6 to 20 percent.

About 65 percent of this unit is near soils underlain by acid sandstone, siltstone, and shale. Among them are Allegheny, Frondorf, Hartsells, and Linker soils. The rest of the acreage is mostly near Baxter, Colbert, and Talbott soils and is underlain by limestone.

Gullied land is mostly strongly acid or very strongly acid, has low natural fertility and very low organic-matter content, and is droughty. It is unsuitable for crops, and most of it is unsuitable for pasture without extensive reclamation. It is better suited to trees and wildlife habitat. (Capability unit VIIe-1; woodland group not assigned)

Hartsells Series

The Hartsells series consists of moderately deep, well-drained soils on ridgetops and sides of ridges. These soils formed mainly in residuum derived from acid sandstone. Slopes range from 6 to 12 percent.

In a representative profile the surface layer is brown loam about 6 inches thick. The subsoil is yellowish-brown silty clay loam that grades to fine sandy loam between depths of 15 and 24 inches. The substratum is mottled yellowish-brown, pale-brown, and yellowish-red fine sandy loam that is 30 percent sandstone fragments less than 2 inches in diameter. Sandstone bedrock is at a depth of 38 inches.

Hartsells soils have a moderately deep root zone and are moderately rapidly permeable. They are generally very strongly acid, but the surface layer is less acid in places where it has been limed.

Areas of these soils that are on ridgetops are used for crops, hay, and pasture. A few of the steeper slopes are wooded.

Figure 6.—**A 12-year-old stand of loblolly pine. The soil is Frondorf silt loam, 12 to 20 percent slopes. This area was severely gullied when trees were planted.**

Representative profile of Hartsells loam, 6 to 12 percent slopes, in a field along State Highway 1038, 3 miles north of Auburn:

Ap—0 to 6 inches, brown (10YR 5/3) loam; weak, fine, granular structure; very friable; many fine roots; medium acid; clear, smooth boundary.

B1t—6 to 15 inches, yellowish-brown (10YR 5/8) light silty clay loam; moderate, medium, subangular blocky structure; friable; many fine roots; few, thin, patchy clay films; very strongly acid; gradual, smooth boundary.

B2t—15 to 24 inches, yellowish-brown (10YR 5/6) fine sandy loam; weak, fine, subangular blocky structure; friable; thin continuous clay films on most sand grains; very strongly acid; gradual, smooth boundary.

C—24 to 38 inches, mottled yellowish-brown (10YR 5/6), pale-brown (10YR 6/3), and yellowish-red (5YR 5/8) fine sandy loam; massive; very friable; 30 percent, by volume, sandstone fragments, less than 2 inches in diameter; very strongly acid; abrupt, smooth boundary.

R—38 inches +, sandstone bedrock.

The solum ranges from 20 to 40 inches in thickness, and depth to sandstone, shale, and siltstone bedrock is 20 to 40 inches. The profile is very strongly acid throughout unless limed. Content of coarse fragments ranges from 0 to 10 percent in the A and B horizons and 5 to 30 percent in the C horizon.

The Ap horizon is brown (10YR 5/3 or 4/3). The B horizon is yellowish-brown (10YR 5/4, 5/6, or 5/8) fine sandy loam, sandy clay loam, loam, or light silty clay loam. The C horizon, where present, is fine sandy loam, sandy loam, or loamy sand.

Hartsells soils are near Frondorf, Sadler, and Wellston soils. They contain more sand and fewer coarse fragments than Frondorf soils. They are better drained than Sadler soils and do not have a fragipan. They are more sandy and are shallower over bedrock than Wellston soils.

Hartsells loam, 6 to 12 percent slopes (HaC).—This soil is on long, narrow ridgetops and, to a minor extent, on toe slopes and benches. Areas are generally long and narrow and range from 2 to 20 acres in size.

Included with this soil in mapping were small areas of Wellston and Frondorf soils and a few areas of severely eroded Hartsells soils, which are identified on the soil map by a spot symbol.

This Hartsells soil is very strongly acid unless limed. It has low natural fertility and is droughty where it is less than 30 inches deep over rock. It is easy to till.

This soil is suited to most of the row crops and hay and pasture plants commonly grown in the county. Erosion is a severe hazard. Soil-conserving practices are needed to slow runoff and reduce erosion. (Capability unit IIIe–5; woodland group 2o1)

Johnsburg Series

The Johnsburg series consists of somewhat poorly drained soils on broad, smooth uplands and in some slight depressions. These soils formed in a silty mantle 1½ to 3 feet thick and in the underlying residuum, which was derived from sandstone, siltstone, and shale. They have a compact fragipan.

In a representative profile the surface layer is dark grayish-brown silt loam 4 inches thick over pale-brown silt loam 6 inches thick. The subsoil extends to a depth of 56 inches or more. It is pale-brown silt loam that has common yellowish-brown and light-gray mottles in the upper 10 inches. The lower part of the subsoil is a compact fragipan that is gray silt loam in the upper part and grades to silty clay loam at a depth of about 41 inches.

Johnsburg soils have a moderately deep to shallow root zone over a very slowly permeable fragipan. They are normally strongly acid or very strongly acid, but the surface layer is less acid in places where it has been limed.

Most areas of Johnsburg soils are used for hay and pasture. A few areas, generally those that have the best surface drainage or that have been drained, are used for corn and soybeans.

Representative profile of Johnsburg silt loam, 50 feet east of Buena Vista Road, 2 miles north of intersection with State Highway 178, 2.5 miles west of Russellville:

A1—0 to 4 inches, dark grayish-brown (10YR 4/2) silt loam; weak, very fine, granular structure; very friable; strongly acid; abrupt, smooth boundary.

A2—4 to 10 inches, pale-brown (10YR 6/3) silt loam; few faint mottles of dark grayish brown (10YR 4/2); weak, fine, granular structure; friable; very strongly acid; clear, smooth boundary.

B1t—10 to 20 inches, pale-brown (10YR 6/3) silt loam; common, medium, distinct mottles of light gray (10YR 7/2) and yellowish brown (10YR 5/6); weak, fine, subangular blocky structure; friable; patchy clay films on ped faces; strongly acid; clear, smooth boundary.

Bx1—20 to 30 inches, gray (10YR 6/1) silt loam; common, medium, faint mottles of light gray (10YR 7/1) and yellowish brown (10YR 5/6); strong, very coarse, prismatic structure parting to weak or moderate, fine or medium, subangular blocky; firm, brittle and friable; common, medium, brown and black concretions; very strongly acid; clear, smooth boundary.

Bx2—30 to 41 inches, gray (10YR 6/1) heavy silt loam; common, medium, distinct mottles of pale brown (10YR 6/3) and brownish yellow (10YR 6/8); strong, very coarse, prismatic structure parting to weak or moderate, fine or medium, subangular blocky; firm, brittle; very strongly acid; clear, smooth, boundary.

Bx3—41 to 56 inches +, light-gray (10YR 7/1) silty clay loam; many silt coatings of white (10YR 8/1) and brownish yellow (10YR 6/8); weak, very coarse, prismatic structure; firm, hard and brittle; very strongly acid.

The solum ranges from 42 to 60 inches in thickness. The profile is strongly acid or very strongly acid unless limed. Depth to the fragipan ranges from 18 to 26 inches.

The A1 and Ap horizons range from dark grayish brown (10YR 4/2) to light brownish gray (10YR 6/2). The A2 horizon ranges from gray (10YR 5/1) to pale brown (10YR 6/3) mottled with shades of brown. The B1t horizon is pale brown (10YR 6/3), yellowish brown (10YR 5/4 or 5/6), or light yellowish brown (10YR 6/4) mottled with shades of gray and brown. The Bx horizon ranges from yellowish brown (10YR 5/6) to gray (10YR 6/1) mottled with shades of gray, brown, and yellow. It is loam, silt loam, or silty clay loam.

Johnsburg soils are near Zanesville and Sadler soils. They are more poorly drained than those soils.

Johnsburg silt loam (Jo).—This soil is on broad, smooth uplands. Slopes range from 0 to 3 percent. Areas range from 2 to 20 acres in size, and some of them are slight depressions in the landscape. Included in mapping were a few small areas of Sadler soils.

This Johnsburg soil is generally strongly acid or very strongly acid. It has low natural fertility and low organic-matter content. The seasonal high water table at a depth of 6 to 18 inches limits the selection of plants and delays planting in spring.

This soil is mostly used for hay and pasture plants that tolerate moderate wetness. The seasonal high water table and the shallow root zone make it unsuitable for tobacco and alfalfa. Surface drainage lengthens the time for field work and widens the selection of suitable plants. (Capability unit IIIw–2; woodland group 2w1)

Karnak Series

The Karnak series consists of deep, poorly drained soils on lowlying flood plains. These soils formed in clayey alluvium deposited by slack water.

In a representative profile the surface layer is dark grayish-brown silty clay 10 inches thick. The subsoil is gray silty clay mottled with yellowish red, strong brown, and yellowish brown. It extends to a depth of 54 inches or more.

Karnak soils have a deep root zone and are slowly permeable. The seasonal high water table delays fieldwork and planting in spring. These soils are subject to flooding during winter and spring.

Most areas of Karnak soils are used for hay and pasture. A few are wooded. Corn, soybeans, and other row crops are suitable if the soils are adequately drained.

Representative profile of Karnak silty clay, 200 yards north of the bridge where State Highway 585 crosses Wolf Lick Creek, about 1.8 miles west of intersection with State Highway 1153 and about 6.5 miles north of Lewisburg:

Ap—0 to 10 inches, dark grayish-brown (10YR 4/2) silty clay; common faint mottles of light brownish gray (10YR 6/2) and strong brown (7.5YR 5/6); weak, fine, subangular blocky structure; firm; common roots; slightly acid; abrupt, smooth boundary.

B1g—10 to 32 inches, gray (10YR 5/1) silty clay; common, fine, prominent mottles of yellowish red (5YR 4/6) and yellowish brown (10YR 5/6); weak, fine, subangular blocky sructure; firm; few, fine, brown and black concretions; common roots; slightly acid; gradual, smooth boundary.

B2g—32 to 54 inches +, gray (10YR 5/1) silty clay; many, medium, prominent mottles of yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6); moderate, medium, angular blocky structure; firm; few, fine, black and brown concretions; slightly acid.

The solum ranges from 36 to 60 inches in thickness. The profile is slightly acid to medium acid.

The Ap horizon ranges from dark grayish brown (10YR 4/2) to grayish brown (10YR 5/2) silty clay or clay. The B horizon ranges from gray (10YR 5/1 or 6/1) to grayish brown (10YR 5/2) mottled with shades of red and brown. It is silty clay or clay that has weak to moderate, fine or medium, subangular and angular blocky structure.

Karnak soils are near Newark and Melvin soils. They are less coarse and are darker than Newark and Melvin soils. They are more poorly drained than Newark soils.

Karnak silty clay (Ka).—This soil is on low-lying flood plains. Slopes range from 0 to 2 percent.

This soil is slightly acid to medium acid. It has a seasonal high water table and is saturated for long periods. The silty clay surface layer and wetness make it difficult to till. Flooding is a hazard during winter and spring.

This soil is mostly used for hay and pasture plants. Some areas remain in trees. If adequately drained, this soil is suited to corn, soybeans, tall fescue, Ladino clover, Alsike clover, and Korean lespedeza. (Capability unit IIIw-3; woodland group 1w2)

Lawrence Series

The Lawrence series consists of nearly level to concave, somewhat poorly drained soils on stream terraces and uplands. These soils have a compact fragipan. They formed in old alluvium and in residuum derived mainly from limestone.

In a representative profile the surface layer is light olive-brown silt loam 8 inches thick. The subsoil extends to a depth of 52 inches or more. It is light yellowish-brown silty clay loam mottled with gray and brown in the upper 14 inches. The lower part is a compact fragipan of mottled light-gray, yellowish-brown, and strong-brown silty clay loam.

Lawrence soils have a moderately deep root zone over a slowly permeable fragipan. They have low organic-matter content and are generally strongly acid to very strongly acid in reaction, but the surface layer is less acid where limed.

Most areas of Lawrence soils are used for hay and pasture. A few small areas are wooded.

Representative profile of Lawrence silt loam, on the east side of State Highway 675, 100 feet west of Black Lick Creek and 0.25 mile east of intersection with State Highway 103, 1.3 miles north of Auburn:

Ap—0 to 8 inches, light olive-brown (2.5Y 5/4) silt loam; weak, fine, granular structure; very friable; many roots; strongly acid; clear, smooth boundary.

B21t—8 to 15 inches, light yellowish-brown (2.5Y 6/4) light silty clay loam; common, fine, distinct mottles of light brownish gray (2.5Y 6/2); weak, fine, subangular blocky structure; friable; few fine roots; few, fine, brown concretions; patchy clay films on ped faces; strongly acid; gradual, smooth boundary.

B22t—15 to 22 inches, light yellowish-brown (2.5Y 6/4) light silty clay loam; common, fine and medium, distinct mottles of yellowish brown (10YR 5/4) and pale brown (10YR 6/3); moderate, medium, subangular blocky structure; slightly firm, compact and brittle; common, fine, brown concretions; patchy clay films on some ped faces; strongly acid; clear, smooth boundary.

Bx1—22 to 39 inches, mottled light-gray (2.5Y 7/2), yellowish-brown (10YR 5/6), and strong-brown (7.5Y 5/6) silty clay loam; moderate, very coarse, prismatic structure parting to moderate, medium, angular blocky; very firm, compact and brittle; common black and dark-brown concretions; few vertical streaks of light-gray (2.5Y 7/2) silty clay between prisms in lower 12 inches; common thin clay films on blocks; strongly acid; clear, smooth boundary.

Bx2—39 to 52 inches +, mottled light-gray (2.5Y 7/2) and yellowish-brown (10YR 5/4 and 5/6) silty clay loam; few vertical streaks of light-gray (2.5Y 7/2) silty clay between prisms; moderate, very coarse, prismatic structure parting to moderate, medium, angular blocky; very firm, compact and brittle; common black concretions; common thin clay films on blocks; strongly acid.

The solum ranges from 40 to 72 inches in thickness, and depth to bedrock ranges from 60 to 120 inches or more. Depth to the fragipan ranges from 18 to 30 inches. The profile is generally strongly acid or very strongly acid, but the surface layer is less acid in places where it has been limed.

The Ap horizon ranges from light olive brown (2.5Y 5/4) to dark yellowish brown (10YR 4/4). The B2t horizon ranges from pale brown (10YR 6/3) to light yellowish brown (2.5Y 6/4) mottled with shades of brown and gray. It is silt loam or silty clay loam. The Bx horizon either is mottled light gray (2.5Y 7/2), yellowish brown (10YR 5/4 and 5/6), and strong brown (7.5YR 5/6) or has one of these colors dominant and is mottled with the other colors. In places this soil has a silty clay or clay B3t horizon instead of a Bx2 horizon.

Lawrence soils are near Nicholson and Robertsville soils. They are more poorly drained than the moderately well drained Nicholson soils and better drained than the poorly drained Robertsville soils.

Lawrence silt loam (La).—This nearly level soil is on stream terraces and level to concave uplands. Areas range from 2 to 25 acres in size.

This soil has a seasonal high water table at a depth of 6 to 18 inches. It is slowly permeable in the fragipan. It is easy to till except for wetness early in spring. Wetness generally delays planting.

This soil is suited to most shallow-rooted crops that tolerate wetness. It is mostly used for hay and pasture. Some areas remain in trees. A few areas that have been drained are used for corn and soybeans. Surface drainage lengthens the time for fieldwork and widens the selection of suitable plants. (Capability unit IIIw-2; woodland group 2w1)

Lindside Series

The Lindside series consists of deep, moderately well drained soils on flood plains and in upland depressions

and drainageways. These soils formed in young alluvium washed from uplands underlain by limestone.

In a representative profile the surface layer is brown silt loam 8 inches thick. The subsoil extends to a depth of 25 inches and is brown silt loam mottled with shades of brown and gray below a depth of about 14 inches. The substratum to a depth of 68 inches or more is light brownish-gray silt loam mottled with gray and brown.

Lindside soils have a deep root zone and are moderately permeable. They range from neutral to medium acid in reaction. Flooding normally occurs during winter and early in spring, but floods are of short duration.

Most areas of these soils are used for row crops year after year. Some areas are used for hay, pasture, or trees.

Representative profile of Lindside silt loam, 115 feet north of bridge where State Highway 1153 crosses Mud River and about 100 feet west of the highway, about 6 miles northeast of Lewisburg:

Ap—0 to 8 inches, brown (10YR 4/3) silt loam; weak, fine, granular structure; very friable; neutral; clear, smooth boundary.

B1—8 to 18 inches, brown (10YR 4/3) silt loam; few, fine, faint mottles of light brownish gray (10YR 6/2) in lower part; weak, fine, granular structure; very friable; neutral; gradual, smooth boundary.

B2—18 to 25 inches, brown (10YR 4/3) silt loam; common, medium, faint mottles of grayish brown (10YR 5/2) and dark grayish brown (10YR 4/2); weak, fine, granular structure; very friable; few, fine, black concretions; neutral; clear, smooth boundary.

Cg—25 to 68 inches +, light brownish-gray (10YR 6/2) silt loam; common gray (10YR 6/1) and brown (10YR 5/3) mottles; massive; friable; common brown and black concretions; neutral.

The solum ranges from 25 to 50 inches in thickness. The profile is neutral to medium acid.

The Ap horizon ranges from brown (10YR 4/3 or 5/3) to brown (7.5YR 4/2). It is commonly silt loam, but in places is loam and fine sandy loam. The B horizon ranges from brown (10YR 4/3 or 5/3) to brown (7.5YR 4/4) mottled with shades of gray and brown below a depth of about 14 inches. In places the C horizon is stratified with coarser textured material.

Lindside soils are near Nolin and Newark soils. They are not so well drained as the well-drained Nolin soils and are better drained than the somewhat poorly drained Newark soils.

Lindside silt loam (0 to 2 percent slopes) (Ld).—This soil is on flood plains and in upland depressions and drainageways. Areas range from 2 to 40 acres in size.

Included with this soil in mapping were a few small areas of Lindside loam and Lindside fine sandy loam and small areas of Nolin and Newark soils.

This Lindside soil has a seasonal high water table at a depth of 18 to 36 inches. It is subject to flooding of short duration, commonly during winter and early in spring. It is easy to till.

This soil is suited to most of the row crops and hay and pasture plants commonly grown in the county. Flooding is a slight hazard to some perennial plants, such as alfalfa. (Capability unit I-2; woodland group 1w1)

Linker Series

The Linker series consists of moderately deep to deep, well-drained soils on the tops and sides of ridges. These soils formed in residuum weathered from sandstone, siltstone, and shale. Slopes range from 2 to 12 percent.

In a representative profile the surface layer is brown loam about 8 inches thick. The subsoil extends to a depth of 48 inches. It is yellowish-red sandy clay loam in the upper 20 inches and red and variegated reddish-brown, yellowish-red, and red clay loam in the lower part. Sandstone conglomerate is at a depth of 48 inches.

Linker soils have a moderately deep and deep root zone and are moderately permeable. They are generally very strongly acid.

These soils are used mostly for row crops, hay, and pasture. A few areas are wooded.

Representative profile of Linker loam, 6 to 12 percent slopes, about 0.3 mile east of State Highway 1153, adjacent to the Butler County line:

Ap—0 to 8 inches, brown (10YR 5/3) loam; weak, fine, granular structure; friable; many roots; few small quartz pebbles; very strongly acid; clear, smooth boundary.

B1t—8 to 13 inches, yellowish-red (5YR 4/8) light sandy clay loam; weak, medium, subangular blocky structure; friable; few patchy clay films; common roots; few small quartz pebbles; very strongly acid; clear, wavy boundary.

B2t—13 to 28 inches, yellowish-red (5YR 4/6) sandy clay loam; moderate, medium, subangular blocky structure; slightly firm; common thin clay films; few, small, black concretions; few fine roots; few small quartz pebbles; very strongly acid; clear, wavy boundary.

B31t—28 to 38 inches, red (2.5YR 5/6) clay loam; moderate, medium, angular blocky structure; slightly firm; many thin clay films; few fine roots; about 15 percent quartz pebbles, by volume; common black concretions; very strongly acid; clear, wavy boundary.

B32—38 to 48 inches, variegated, reddish-brown (5YR 5/4), yellowish-red (5YR 5/8), and red (2.5YR 5/6) clay loam; moderate, medium, angular blocky structure; slightly firm; few small quartz pebbles; common, weathered, sandstone fragments; very strongly acid; gradual, wavy boundary.

R—48 inches +, acid sandstone conglomerate.

The solum ranges from 24 to 48 inches in thickness and is underlain by bedrock. The profile is generally strongly acid or very strongly acid, but the surface layer is less acid where limed. Quartz pebbles, less than one-half inch in diameter, make up 0 to 3 percent of the Ap, B1t, and B2t horizons. Quartz pebbles and sandstone fragments make up 3 to 15 percent of the B3 horizon.

The Ap horizon is brown (10YR 4/3 or 5/3) or yellowish brown (10YR 5/4). The B1t and B2t horizons are yellowish red (5YR 4/6 or 4/8) or red (2.5YR 4/6 or 4/8). The B3 horizon, including variegations, ranges from reddish brown (5YR 5/4) to red (2.5YR 4/8).

Linker soils are near Hartsells, Wellston, and Zanesville soils. They have a redder subsoil than Hartsells soils. They are more sandy in the surface layer and upper part of the subsoil than Wellston and Zanesville soils, which formed partly in loess. They are better drained than Zanesville soils.

Some areas of these soils have a slightly thicker solum and are slightly deeper over bedrock than is defined as the range for the series, but these differences do not significantly affect the usefulness or behavior of the soils.

Linker loam, 2 to 6 percent slopes (LnB).—This soil is on narrow ridgetops. Areas range from 2 to 12 acres in size. Included in mapping were a few small areas of Hartsells and Zanesville soils.

This Linker soil is generally very strongly acid and has low natural fertility. It is easy to till.

This soil is suited to most of the row crops and hay and pasture plants commonly grown in the county. Erosion is a moderate hazard in cultivated areas. Soil-conserving practices therefore are needed to slow runoff and reduce erosion. (Capability unit IIe-4; woodland group 2o1)

Linker loam, 6 to 12 percent slopes (LnC).—This soil is on narrow ridgetops and sides of ridges. The areas are generally long and narrow and range from 2 to 10 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping were a few areas where the surface layer is 5 to 15 percent rounded quartz gravel. A few areas of severely eroded soils also were included and are identified on the soil map by a spot symbol.

This Linker soil has low natural fertility and is droughty where it is less than 30 inches deep over bedrock. It is generally very strongly acid. It is easy to till.

This soil is suited to most of the row crops and hay and pasture plants commonly grown in the county (fig. 7). Erosion is a severe hazard in cultivated areas, and soil-conserving practices therefore are needed to slow runoff and reduce erosion. (Capability unit IIIe-5; woodland group 2o1)

Melvin Series

The Melvin series consists of nearly level, deep, poorly drained soils on flood plains. These soils formed in alluvial material washed from soils derived chiefly from limestone and, to a lesser extent, from shale and sandstone.

In a representative profile the surface layer is dark grayish-brown silt loam 9 inches thick. The subsoil is light brownish-gray and gray silt loam that extends to a depth of 42 inches. The substratum to a depth of 60 inches is light-gray silty clay loam.

Melvin soils have a deep root zone and are moderately permeable. Most areas are flooded once or twice each year. The seasonal high water table is at or near the surface during winter and early in spring.

Most areas of Melvin soils are used for hay, pasture, or trees. Some areas remain in native woodland.

Representative profile of Melvin silt loam, 500 feet north of the bridge where State Highway 1153 crosses Mud River and 250 feet west of the highway, about 6 miles northeast of Lewisburg:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; many, medium, faint mottles of grayish brown (10YR 5/2); weak, fine, granular and subangular blocky structure; friable; common roots; medium acid; clear, smooth boundary.

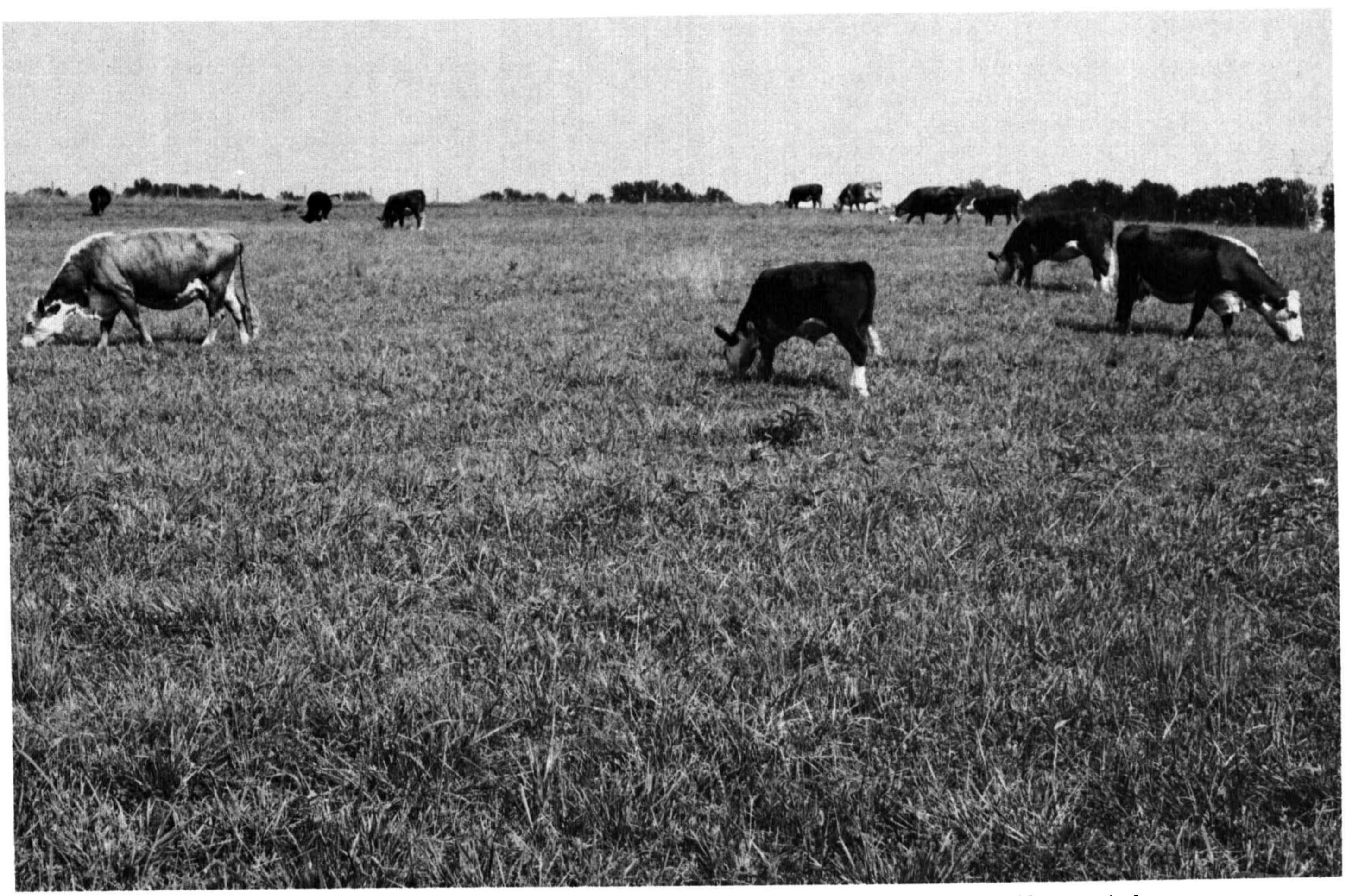

Figure 7.—Beef cattle grazing on Kentucky 31 fescue. The soil is Linker loam, 6 to 12 percent slopes.

B1g—9 to 22 inches, light brownish-gray (2.5Y 6/2) silt loam; common, medium, distinct mottles of dark grayish brown (2.5Y 4/2); weak, fine, subangular blocky structure; friable; few fine roots; common brown concretionary stains; medium acid; gradual, smooth boundary.

B2g—22 to 42 inches, gray (10YR 5/1) silt loam; many, medium, distinct mottles of dark grayish brown (2.5Y 4/2) and yellowish brown (10YR 5/6); weak, fine, subangular blocky structure; friable; medium acid; gradual, smooth boundary.

Cg—42 to 60 inches +, light-gray (5Y 7/1) light silty clay loam; common, coarse, prominent mottles of brown (7.5YR 4/4) and grayish brown (2.5Y 5/2); massive; friable, slightly sticky; common black and brown concretions; medium acid.

The solum ranges from 22 to 42 inches in thickness. Depth to bedrock ranges from 4 to more than 10 feet. The profile is medium acid to neutral.

The Ap horizon ranges from dark grayish brown (10YR 4/2) to light gray (5Y 7/1). The B horizon ranges from light gray (5Y 7/2) to dark gray (10YR 4/1) mottled with shades of brown. It has weak or moderate, fine or medium, subangular blocky structure. The C horizon ranges from light-gray (5Y 7/1) to dark-gray (N 4/0) silt loam or light silty clay loam. Small black or brown concretions range from none to common throughout the profile.

Melvin soils are near Newark and Lindside soils. They are not so well drained as Newark and Lindside soils and have more gray colors in the upper part of the subsoil.

Melvin silt loam (Me).—This nearly level soil is on flood plains. Areas range from 2 to 18 acres in size. Included in mapping were a few small areas of Newark soils.

This Melvin soil is generally medium acid, but ranges almost to neutral. It has a seasonal high water table at or near the surface for several months during winter and spring. Most areas are flooded once or twice each year.

This soil is mostly used for hay, pasture, or trees. Only those plants that tolerate wetness are suitable. Drainage, both surface and tile, widen the selection of plants that can be grown. (Capability unit IIIw-1; woodland group 1w2)

Newark Series

The Newark series consists of somewhat poorly drained soils on flood plains. These soils formed in mixed alluvium derived from limestone, sandstone, and shale.

In a representative profile the surface layer is brown silt loam about 9 inches thick. The subsoil extends to a depth of 29 inches. It is grayish-brown silt loam mottled with brown in the upper 10 inches and gray silt loam mottled with brown in the lower part. The substratum to a depth of 58 inches or more is gray silty clay loam mottled with yellowish brown and strong brown.

Newark soils have a deep root zone and are moderately permeable. They are generally medium acid.

These soils are used for row crops, hay, and pasture. They are better suited to water-tolerant plants than to others.

Representative profile of Newark silt loam, 350 feet north of bridge where State Highway 1153 crosses Mud River and 150 feet west of the highway, about 6 miles northeast of Lewisburg:

Ap—0 to 9 inches, brown (10YR 4/3) silt loam; weak, fine, granular structure; very friable; medium acid; clear, smooth boundary.

B21—9 to 19 inches, grayish-brown (10YR 5/2) silt loam; many, fine and medium, faint mottles of brown (10YR 5/3); weak, fine, granular structure; very friable; common black and brown concretionary stains; medium acid; gradual, smooth boundary.

B22g—19 to 29 inches, gray (10YR 5/1) heavy silt loam; few distinct mottles of brown (10YR 4/3); weak, very fine, subangular blocky structure; friable; common, medium, black and brown concretions; medium acid; gradual, smooth boundary.

Cg—29 to 58 inches +, gray (10YR 6/1) silty clay loam: common, medium, prominent mottles of strong brown (7.5YR 5/6) and yellowish brown (10YR 5/6); massive; friable; medium acid.

The solum ranges from 20 to 40 inches in thickness, and depth to bedrock ranges from 4 to 20 feet. The profile ranges from neutral to medium acid.

The Ap horizon ranges from brown (7.5YR 4/4) to dark grayish brown (10YR 4/2). It is dominantly silt loam, but ranges to silty clay loam. The B21 horizon ranges from grayish brown (10YR 5/2) to brown (10YR 4/3). The B22g horizon is gray (10YR 5/1 or 6/1) or light brownish gray (10YR 6/2 or 2.5Y 6/2). The B horizon is silt loam or light silty clay loam. It has weak or moderate, very fine to moderate, granular or subangular blocky structure. The Cg horizon has the same color as the B22g horizon. It is silt loam or silty clay loam.

Newark soils are near the moderately well drained Lindside soils and the poorly drained Melvin soils.

Newark silt loam (Ne).—This nearly level soil is on flood plains. Areas range from 2 to 35 acres in size. Included in mapping were small areas of Lindside and Melvin soils.

This Newark soil is generally medium acid and has moderate permeability. It has a seasonal high water table at a depth of 6 to 18 inches during winter and early in spring. It is subject to flooding, commonly during the same period.

If drained, this soil is suited to most of the row crops and hay and pasture plants commonly grown in the county (fig. 8). It is generally unsuitable for tobacco and alfalfa. Only those plants that tolerate wetness can be grown in undrained areas. (Capability unit IIw-1; woodland group 1w1)

Nicholson Series

The Nicholson series consists of moderately well drained soils on upland ridgetops and stream terraces. These soils have a compact fragipan below a depth of about 2 feet. They formed in loess or silty residuum and in the underlying clayey residuum derived from limestone and calcareous shale. Slopes range from 0 to 12 percent.

In a representative profile the surface layer is brown silt loam about 8 inches thick. The subsoil extends to a depth of 42 inches or more. It is strong-brown heavy silt loam grading to yellowish-brown silty clay loam in the upper 17 inches. The lower part of the subsoil is a very firm, compact fragipan. The pan is brown heavy silt loam mottled with gray and yellowish brown to a depth of about 33 inches and mottled light brownish-gray, very pale brown, and yellowish-brown silty clay loam to a depth of 42 inches.

Nicholson soils have a moderately deep root zone over a compact, slowly permeable fragipan.

Most areas of Nicholson soils are used for row crops, hay, or pasture. A few very small areas are wooded.

Figure 8.—**Soybeans growing on Newark silt loam that has been tile drained.**

Representative profile of Nicholson silt loam, 0 to 2 percent slopes, 50 feet east of State Highway 765 and 0.25 mile south of Red River, about 2.6 air miles south of Schochoh:

Ap—0 to 8 inches, brown (10YR 4/3) silt loam; weak, fine, granular structure; friable; common roots; slightly acid; clear, smooth boundary.

B1t—8 to 15 inches, strong-brown (7.5YR 5/6) heavy silt loam; weak, medium, subangular blocky structure; friable; few fine roots; patchy clay films on some peds; neutral; clear, smooth boundary.

B2t—15 to 25 inches, yellowish-brown (10YR 5/6) silty clay loam; moderate, medium, subangular blocky structure; firm; few fine roots; thin patchy clay films; few, small, brown concretions; strongly acid; clear, wavy boundary.

Bx1—25 to 33 inches, brown (7.5YR 5/4) heavy silt loam; common, medium, distinct mottles of gray (10YR 6/1) and yellowish brown (10YR 5/6); moderate, very coarse, prismatic structure parting to moderate, medium, angular blocky; very firm, brittle and compact; thin gray clay films on prism faces; common black concretionary stains; strongly acid; gradual, wavy boundary.

Bx2—33 to 42 inches +, mottled light brownish-gray (2.5Y 6/2), very pale brown (10YR 7/4), and yellowish-brown (10YR 5/6) silty clay loam; moderate, very coarse, prismatic structure parting to moderate, medium, angular blocky; very firm, brittle and compact; thin clay films on ped faces; few small round concretions; very strongly acid.

The solum ranges from 40 to 75 inches in thickness, and depth to bedrock ranges from 60 to 84 inches. The profile generally ranges from medium acid to very strongly acid, but the surface layer and upper part of the subsoil are less acid where limed. Depth to the fragipan ranges from 20 to 30 inches.

The Ap horizon is brown (10YR 4/3 or 5/3) or yellowish brown (10YR 5/4). The Bt horizon ranges from brown (7.5YR 4/4) to yellowish brown (10YR 5/6) heavy silt loam or silty clay loam. The Bx horizon ranges from brown (7.5YR 5/4) to yellowish brown (10YR 5/6) and is mottled with shades of gray and brown. In some places the Bx horizon is mottled and does not have a dominant color. It is silt loam or silty clay loam. In some places this soil has a silty clay or clay B3 horizon instead of a Bx2 horizon.

Nicholson soils are near Crider and Lawrence soils. They are not so well drained as the well-drained Crider soils and are better drained than the somewhat poorly drained Lawrence soils.

Nicholson silt loam, 0 to 2 percent slopes (NhA).—This soil is on broad, smooth ridgetops and low stream terraces. Areas range from 2 to 25 acres in size. This soil has the profile described as representative of the series. Included in mapping were a few small areas of Crider and Lawrence soils.

This Nicholson soil is generally strongly acid, but the surface layer is less acid where limed. Erosion is not a hazard. This soil is easy to till, except when wet early in spring. It has a seasonal high water table at a depth of about 18 to 30 inches during winter and early in spring.

This soil is suited to most of the row crops and hay and pasture plants commonly grown in the county. It is not suited to alfalfa. Tobacco does not grow well in wet years. (Capability unit IIw-2; woodland group 3w1)

Nicholson silt loam, 2 to 6 percent slopes (NhB).—This soil is on broad ridgetops and stream terraces. Areas range from 2 to 40 acres in size. Included in mapping were a few small areas of Crider soils.

This Nicholson soil is generally strongly acid. It has a seasonal high water table at a depth of about 18 to 30 inches during winter and early in spring.

This soil is suited to most of the row crops and hay and pasture plants commonly grown in the county (fig. 9). It is not suited to alfalfa. Erosion is a hazard. Soil-conserving practices are needed to slow runoff and reduce erosion. (Capability unit IIe–2; woodland group 3w1)

Nicholson silt loam, 6 to 12 percent slopes (NhC).—This soil is on narrow ridgetops and sides of ridges. Areas are long and narrow and range from 2 to 10 acres in size. Included in mapping were a few small areas of Crider soils.

This Nicholson soil is generally strongly acid. It has a seasonal high water table at a depth of about 18 to 30 inches during winter and early in spring.

This soil is suited to most of the row crops and hay and pasture plants commonly grown in the county. It is not suited to alfalfa. Erosion is a severe hazard. Soil-conserving practices are needed to slow runoff and reduce erosion. (Capability unit IIIe–3; woodland group 3w1)

Nolin Series

The Nolin series consists of nearly level, deep, well-drained soils on flood plains and in upland depressions. These soils formed in alluvium derived from limestone, sandstone, and shale.

In a representative profile the surface layer is brown silt loam about 8 inches thick. The subsoil is brown silt loam that has weak, fine, granular and subangular blocky structure and extends to a depth of 42 inches. The substratum to a depth of 60 inches or more is structureless, brown silt loam mottled with shades of brown and gray.

Nolin soils have a deep root zone and are moderately permeable. They are neutral to slightly acid in reaction.

These soils are used extensively for crops, hay, and pasture.

Representative profile of Nolin silt loam, on the north side of Mud River about 100 yards northeast of bridge where State Highway 1153 crosses Mud River, about 6.0 miles northeast of Lewisburg:

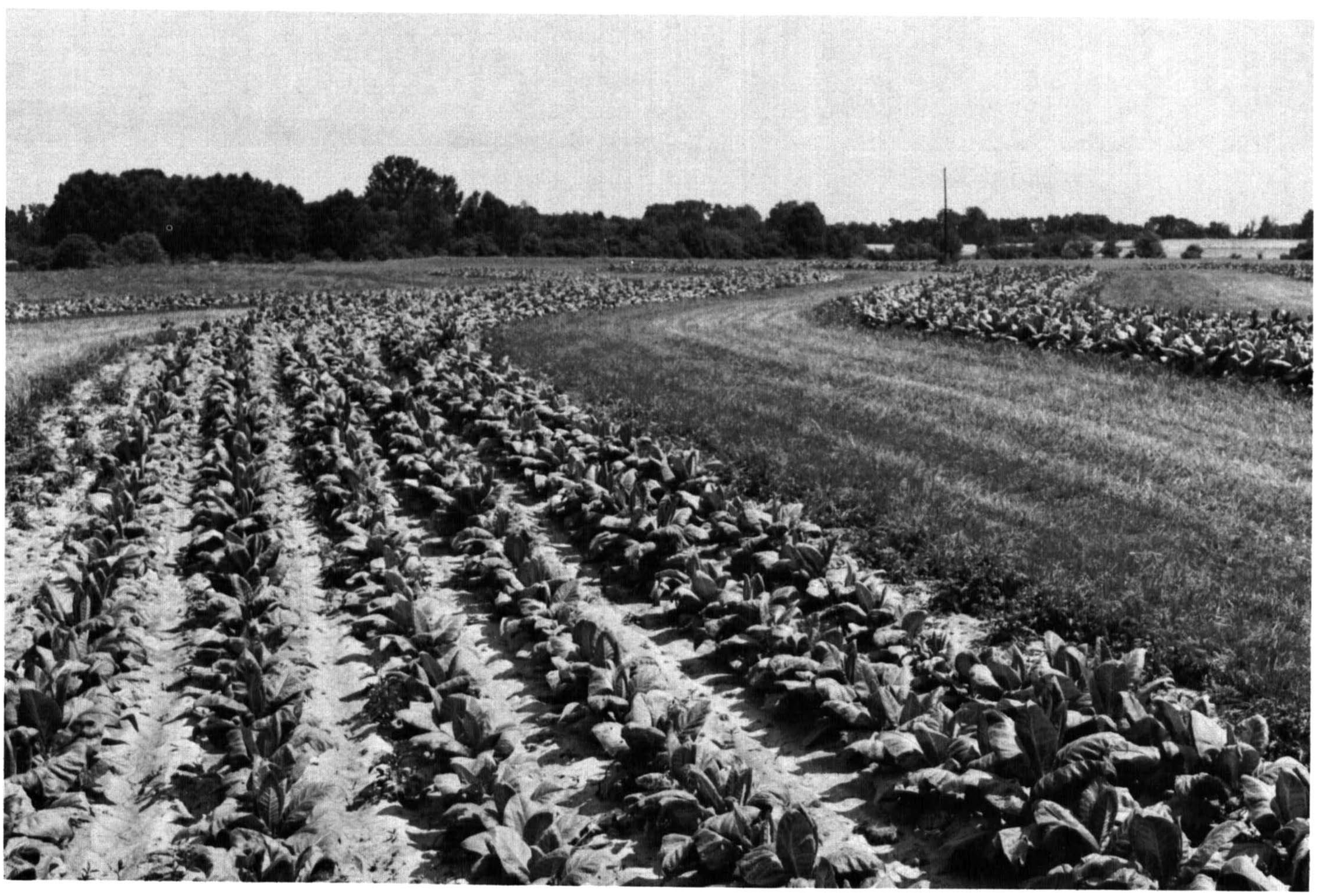

Figure 9.—Narrow contour strips of burley tobacco and a sod crop of Kentucky 31 tall fescue. The soil is Nicholson silt loam, 2 to 6 percent slopes.

Ap—0 to 8 inches, brown (10YR 4/3) silt loam; weak, fine, granular structure; very friable; slightly acid; gradual, smooth boundary.

B—8 to 42 inches, brown (10YR 4/3) silt loam; weak, fine, granular and subangular blocky structure; friable; slightly acid; gradual, smooth boundary.

C—42 to 60 inches +, brown (10YR 4/3) silt loam; few, fine, faint mottles of brown (10YR 5/3) and light brownish gray (10YR 6/2); massive; friable; slightly acid.

The solum is more than 40 inches thick, and the alluvial deposits range from 40 inches to many feet in thickness. Reaction is neutral to medium acid.

The Ap horizon ranges from very dark grayish brown (10YR 3/2) to brown (10YR 5/3). It is dominantly silt loam, but ranges to light silty clay loam. The B horizon is brown (10YR 4/3) or dark yellowish-brown (10YR 4/4) silt loam or light silty clay loam. It has weak to moderate, fine to coarse, granular and subangular blocky structure. The C horizon ranges from dark grayish brown (10YR 4/2) to yellowish brown (10YR 5/4). In some places a few faint mottles in shades of brown and gray are below a depth of about 3 feet.

The well drained Nolin soils are near the moderately well darined Lindside and the somewhat poorly drained Newark soils.

Nolin silt loam (No).—This soil is on flood plains and in upland depressions. Slopes range from 0 to 4 percent. Areas range from 2 to 40 acres in size. Included in mapping were a few areas of a soil that is similar to this Nolin soil, but has a surface layer of fine sandy loam.

This soil is slightly acid to medium acid. It has high natural fertility and is easy to till. It is subject to occasional flooding, commonly late in winter and early in spring. The floods are of short duration.

This soil is suited to all the row crops and hay and pasture plants commonly grown in the county. (Capability unit I–1; woodland group 1o1)

Pembroke Series

The Pembroke series consists of nearly level to sloping, deep, well-drained soils on uplands. These soils formed partly in loess and partly in the underlying limestone residuum or old alluvium. A few areas have karst topography.

In a representative profile the surface layer is dark-brown silt loam about 9 inches thick. The subsoil extends to a depth of 48 inches or more. It is reddish-brown light silty clay loam in the upper 6 inches, red and dark-red silty clay loam in the middle 26 inches, and dark-red silty clay in the lower part.

Pembroke soils have a deep root zone and are moderately permeable. They are slightly acid to strongly acid, but the surface layer is less acid in places where it has been limed.

Most areas of Pembroke soils are used for crops. Pasture and hay are grown in a cropping system with row crops.

Representative profile of Pembroke silt loam, 0 to 2 percent slopes, about 450 yards west of farmhouse that is at the end of a private road northwest 1 mile from State Highway 663, entrance to private road is about 2 miles northeast of intersection with State Highway 100 and about 4 miles northeast of Corinth:

Ap—0 to 9 inches, dark-brown (7.5YR 3/2) silt loam; weak, fine, granular structure; very friable; neutral; clear, smooth boundary.

B1t—9 to 15 inches, reddish-brown (5YR 4/4) light silty clay loam; weak, fine, subangular blocky structure; friable; few clay films; few very small concretions; neutral; gradual, smooth boundary.

B21t—15 to 27 inches, red (2.5YR 4/6) silty clay loam; moderate, medium, subangular blocky structure; friable; common clay films; common, very small, black concretions; slightly acid; gradual, smooth boundary.

B22t—27 to 41 inches, dark-red (2.5YR 3/6) heavy silty clay loam; moderate, medium, subangular blocky structure; friable; common clay films; common black concretions; medium acid; gradual, smooth boundary.

B23t—41 to 48 inches +, dark-red (2.5YR 3/6) silty clay; moderate, medium, blocky structure; firm; common clay films; common black stains on peds; common black concretions; strongly acid.

The solum ranges from 40 to 100 inches in thickness, and depth to bedrock ranges from 60 to 120 inches. The profile is generally slightly acid to strongly acid, but the surface layer and the upper part of the subsoil are less acid in places where the soil has been limed.

The Ap horizon is dark brown (7.5YR 3/2 or 10YR 3/3) to dark reddish brown (5YR 3/3). It is commonly silt loam, but in severely eroded areas is silty clay loam. The B21t horizon is red (2.5YR 4/6), reddish brown (2.5YR 4/4), or yellowish red (5YR 4/6). The B22t and B23t horizons are dark-red (2.5YR 3/6 or 10R 3/6) or red (10R 4/6 or 2.5YR 4/6) silty clay loam or silty clay.

Pembroke soils are near Crider and Nicholson soils. They are darker colored in the Ap horizon and redder and more clayey in the subsoil than Crider and Nicholson soils. They are better drained than Nicholson soils, which have a fragipan.

Pembroke silt loam, 0 to 2 percent slopes (PeA).—This soil is on broad ridgetops. Areas range from 2 to 60 acres in size. This soil has the profile described as representative of the series. Included in mapping were a few small areas of Crider and Nicholson soils.

This Pembroke soil is easy to till and is not subject to erosion. It is suited to all of the row crops and hay and pasture plants commonly grown in the county. It is well suited to tobacco and alfalfa (fig. 10). (Capability unit I–3; woodland group 1o2)

Pembroke silt loam, 2 to 6 percent slopes (PeB).—This soil is on broad ridgetops. Areas range from 2 to 75 acres in size. Included in mapping were small areas of Crider and Nicholson soils.

This soil is suited to all of the row crops and hay and pasture plants commonly grown in the county. It is easy to till. It is one of the better soils in the county for tobacco and alfalfa (fig. 11). Erosion is a hazard. Soil-conserving practices therefore are needed to slow runoff and reduce erosion. (Capability unit IIe–1; woodland group 1o2)

Pembroke silt loam, 6 to 12 percent slopes (PeC).—This soil is on long, narrow ridgetops and on long, narrow side slopes that encircle the more gently sloping soils. Areas range from 2 to 30 acres in size. Included in mapping were a few small areas of eroded Pembroke soils that have a surface layer of heavy silt loam or silty clay loam.

This soil is suited to all of the row crops and hay and pasture plants commonly grown in the county. Erosion is a severe hazard. Soil-conserving practices are needed to slow runoff and reduce erosion. (Capability unit IIIe–1; woodland group 1o2)

Pembroke silty clay loam, 6 to 12 percent slopes, severely eroded (PfC3).—This soil is on long, narrow

Figure 10.—**Strips of dark-fired tobacco growing on Pembroke silt loam, 0 to 2 percent slopes.**

ridgetops and sides of slopes. Areas range from 2 to 35 acres in size. This soil has a profile similar to the one described as representative of the series, but the surface layer is redder and more clayey. Erosion has decreased the suitability of this soil for crops and made the silty clay loam surface layer tend to crust. Included in mapping were a few small areas of Pembroke soils that are not severely eroded and that have a surface layer of silt loam.

This Pembroke soil is suited to most of the row crops and hay and pasture plants commonly grown in the county. It is difficult to till. Erosion is a very severe hazard. Soil-conserving practices therefore are needed to slow runoff and reduce erosion. (Capability unit IVe-5; woodland group 2o1)

Pickwick Series

The Pickwick series consists of deep, well-drained soils on the tops and sides of ridges on old high terraces. These soils formed in old alluvium and loess underlain by residuum derived mainly from limestone. Slopes range from 2 to 12 percent.

In a representative profile the surface layer is brown silt loam about 6 inches thick. The subsoil extends to a depth of 98 inches or more. It is yellowish-red and dark-red silty clay loam in the upper 27 inches and dark-red heavy clay loam and clay in the lower part.

Pickwick soils have a deep root zone and are moderately permeable. They are strongly acid or very strongly acid unless limed.

The more gentle slopes are commonly used for crops, and the steeper slopes are used for hay and pasture. Some small areas remain in trees.

Representative profile of Pickwick silt loam, 6 to 12 percent slopes, on the west side of State Highway 431, 4.5 miles south of Russellville:

Ap—0 to 6 inches, brown (10YR 4/3) silt loam; weak, fine, granular structure; very friable; many roots; slightly acid; clear, smooth boundary.

B1t—6 to 17 inches, yellowish-red (5YR 4/6) silty clay loam; weak, medium, subangular blocky structure; friable; common roots; medium acid; gradual, smooth boundary.

B21t—17 to 33 inches, dark-red (2.5YR 3/6) silty clay loam; moderate, medium, subangular blocky structure; firm; few roots; thin patchy clay films; few organic

Figure 11.—**Burley tobacco on left and alfalfa-grass mixture on right. The soil is Pembroke silt loam, 2 to 6 percent slopes.**

stains on some peds; strongly acid; gradual, smooth boundary.

B22t—33 to 58 inches, dark-red (10R 3/6) heavy clay loam; moderate, medium, angular blocky structure; firm; thin, continuous clay films; few organic stains on peds; strongly acid; gradual, smooth boundary.

B3t—58 to 98 inches +, dark-red (10R 3/6) clay; strong-brown (7.5YR 5/6) mottles; moderate, medium, angular blocky structure; firm; continuous clay films; few chert fragments less than 2 inches in diameter; strongly acid.

The solum is 60 inches or more thick, and depth to bedrock is 6 feet or more. The profile is generally strongly acid or very strongly acid, but the surface layer is less acid where limed.

The Ap horizon is generally brown (10YR 4/3, 10YR 5/3, or 7.5YR 4/4), but in severely eroded areas it is reddish brown (5YR 4/4) or yellowish red (5YR 4/6). It is generally silt loam, but in severely eroded areas it is silty clay loam. The B1 horizon ranges from reddish brown (5YR 4/4) to yellowish red (5YR 4/6). The B21t horizon is yellowish red (5YR 4/6) or dark red (2.5YR 3/6 or 10R 3/6). The B22t and B3t horizons have the same colors as the B21t horizon, but they range from clay loam to clay. The B2 and B3 horizons have moderate to strong, fine to medium, subangular and angular blocky structure. Some profiles have mottles in shades of brown and gray below a depth of about 60 inches.

Pickwick soils are near Crider and Pembroke soils. They have a lower base saturation in the lower part of the subsoil than Crider and Pembroke soils and have a lighter colored surface layer than Pembroke soils.

Pickwick silt loam, 2 to 6 percent slopes (PkB).—This soil is on ridgetops and alluvial fans. Areas range from 2 to 40 acres in size. Included in mapping were small areas of Crider and Pembroke soils.

This Pickwick soil is suited to all of the row crops and hay and pasture plants commonly grown in the county. It is commonly used for tobacco, alfalfa, and other crops that require a deep, well-drained soil (fig. 12). It is generally strongly acid except where it has been limed. It is easy to till. Erosion is a hazard. Soil-conserving practices are needed to slow runoff and reduce erosion. (Capability unit IIe-1; woodland group 2o1)

Pickwick silt loam, 6 to 12 percent slopes (PkC).—This soil is on long, narrow ridgetops or sides of ridges. Areas are long, narrow, and irregular in shape and range from 2 to 15 acres in size. This soil has the profile described as representative of the series. Included in mapping were small areas of Pembroke soils.

This Pickwick soil is suited to all of the row crops and hay and pasture plants commonly grown in the county. It is generally strongly acid except where it has been limed. The slope makes it subject to severe erosion. Soil-conserving practices therefore are needed to slow runoff and reduce erosion. (Capability unit IIIe-1; woodland group 2o1)

Pickwick silty clay loam, 6 to 12 percent slopes, severely eroded (PlC3).—This soil is on side slopes that are severely eroded. It has a profile similar to the one de-

Figure 12.—**Dark-fired tobacco on left and burley tobacco on right. The soil is Pickwick silt loam, 2 to 6 percent slopes.**

scribed as representative of the series, but the plow layer is mostly redder, finer textured subsoil material, as a result of past erosion, and shallow gullies are common. Included in mapping were small areas of soils that have slopes of slightly more than 12 percent.

This soil is generally strongly acid. The texture of the surface layer makes seedbed preparation difficult. This soil can be tilled within only a narrow range of moisture content without clodding. It has very low organic-matter content.

This soil is suited to most of the row crops and hay and pasture plants commonly grown in the county. The very severe hazard of erosion and the difficult seedbed preparation make this soil unsuited to row crops except in a long rotation with grasses and legumes. (Capability unit IVe–5; woodland group 2o1)

Robertsville Series

The Robertsville series consists of poorly drained soils on uplands and terraces. These soils have a firm, very slowly permeably fragipan in the subsoil. They formed mostly in residuum derived from limestone, but in places have some sandstone, shale, or loess.

In a representative profile the surface layer is grayish-brown silt loam about 9 inches thick. The subsoil extends to a depth of 50 inches of more. It is light brownish-gray silt loam mottled with shades of brown and yellow in the upper 23 inches. At a depth of 32 inches is a fragipan that is mottled light gray and yellowish brown in the upper part and is brown with pale-brown and gray mottles in the lower part.

Robertsville soils have a shallow to moderately deep root zone and are very slowly permeable. They are strongly acid to very strongly acid except where they have been limed.

These soils are mainly pastured and wooded.

Representative profile of Robertsville silt loam, on the west side of State Highway 663 and about 3 miles northeast of intersection with State Highway 100, about 5 miles northeast of Corinth:

Ap—0 to 9 inches, grayish-brown (10YR 5/2) silt loam; common, medium, faint, light brownish-gray (10YR 6/2) mottles and dark yellowish-brown (10YR 4/4) concretionary stains; weak, fine, granular structure; friable; many roots; slightly acid; abrupt, smooth boundary.

B1g—9 to 22 inches, light brownish-gray (10YR 6/2) silt loam; common, fine, faint, pale-brown (10YR 6/3) and brownish-yellow (10YR 6/6) mottles; weak, fine medium, subangular blocky structure; friable; common clay films; very strongly acid; clear, smooth boundary.

B2g—22 to 32 inches, light brownish-gray (10YR 6/2) heavy silt loam; few, fine, faint, light yellowish-brown

(10YR 6/4) mottles; weak, medium, subangular blocky structure; friable; common clay films; very strongly acid; clear, wavy boundary.

Bx1—32 to 40 inches, mottled light-gray (10YR 6/1) and yellowish-brown (10YR 5/6) silt loam; strong, very coarse, prismatic structure parting to moderate, coarse, subangular blocky; firm, brittle; nearly continuous clay films; many, medium, black and brown concretions; very strongly acid; gradual, wavy boundary.

Bx2—40 to 50 inches +, brown (7.5YR 4/4) heavy silt loam; medium distinct mottles of pale brown (10YR 6/3) and gray (10YR 6/1); strong, very coarse, prismatic structure parting to moderate, coarse, subangular blocky; firm, brittle; nearly continuous clay films; strongly acid.

The solum ranges from 40 to 60 inches in thickness, and depth to bedrock is more than 6 feet. The profile is generally strongly acid or very strongly acid, but the surface layer is less acid in places where it has been limed. Depth to the fragipan ranges from 16 to 34 inches.

The Ap horizon ranges from light brownish gray (2.5Y 6/2) to grayish brown (10YR 5/2) mottled with shades of brown and gray. The B1g and B2g horizons range from gray (10YR 6/1) to light brownish gray (2.5Y 6/2) mottled with shades of brown and yellow. They are silt loam or silty clay loam that has weak, fine to medium, subangular blocky structure. The Bx horizon is commonly mottled with shades of gray and brown, but in places it has a dominant color of gray or brown mottled with shades of brown or gray. It is silt loam or silty clay loam.

Robertsville soils are near Lawrence soils. They are more poorly drained than Lawrence soils and are grayer in the surface layer and upper part of the subsoil.

Robertsville silt loam (Ro).—This nearly level soil is on broad, smooth uplands and in slight depressions. Areas range from 2 to 20 acres in size. Included in mapping were small areas of Lawrence soils.

This Robertsville soil is strongly acid or very strongly acid unless limed. It has a seasonal high water table at or near the surface for several months during winter and spring, and surface water stands in many undrained areas. Wetness makes this soil difficult to till. Organic-matter content is low, and natural fertility is low.

This soil is suited to hay and pasture plants that tolerate wetness. It is generally unsuited to row crops, except where it has been adequately drained. Some of the better suited row crops are soybeans and corn. Many areas are wooded. (Capability unit IVw-1; woodland group 2w1)

Rock Outcrop

Rock outcrop is mapped only in a complex with Fredonia and Colbert soils.

Rock outcrop-Fredonia-Colbert complex (Rx).—This complex consists of closely intermingled areas of Rock outcrop and Fredonia and Colbert soils on knoblike hills and in areas adjacent to streams and bottom lands. It is approximately 65 percent Rock outcrop, 20 percent Fredonia soils, and 15 percent Colbert soils. Slopes range widely, but are mostly 20 to 50 percent.

Rock outcrop consists mostly of limestone and a few areas of sandstone. The outcrops are in the form of ledges, cliffs, and rounded boulders that range from about 1 to 10 feet in diameter.

The Fredonia soil in this complex is very rocky and is shallower over bedrock than is typical for the Fredonia series. Areas of this soil are small and irregular in shape.

The Colbert soil has a profile similar to the one described as representative of the Colbert series. Areas are irregular in shape and range from a few square feet to half an acre in size.

This complex is used mostly for trees and wildlife habitat. A few areas are used for pasture, but they are suited only to very limited grazing. (Capability unit VIIs-2; woodland group 4x1)

Sadler Series

The Sadler series consists of moderately well drained soils on broad ridgetops. These soils formed in a loess mantle and in the underlying residuum derived from sandstone, siltstone, and shale. Slopes range from 0 to 6 percent.

In a representative profile the surface layer is brown silt loam 7 inches thick. The subsoil extends to a depth of 48 inches. It is yellowish-brown light silty clay loam in the upper 12 inches and yellowish-brown silt loam blocky soil particles that have pale-brown silt loam coatings on the larger particles in the middle 4 inches. The lower part of the subsoil is a compact fragipan of mottled shades of brown and gray light silty clay loam. The substratum to a depth of 78 inches or more is silty clay loam mottled with shades of brown and gray and contains a few sandstone fragments. Black concretions are common in the lower part of the subsoil and in the substratum.

Sadler soils have a moderately deep root zone. They are moderately permeable above the fragipan and slowly permeable in the pan.

These soils are used for crops, hay, and pasture.

Representative profile of Sadler silt loam, 0 to 2 percent slopes, 75 feet northeast of State Highway 103 and 0.1 mile northwest of intersection with State Highway 1038, about 5.5 miles northwest of Auburn:

Ap—0 to 7 inches, brown (10YR 5/3) silt loam; weak, fine, granular structure; very friable; strongly acid; abrupt, smooth boundary.

B2t—7 to 19 inches, yellowish-brown (10YR 5/6) light silty clay loam; few, faint, brown mottles; weak, medium, subangular blocky structure; friable; few, fine, brown concretions; strongly acid; gradual, wavy boundary.

B&A'2—19 to 23 inches, 50 percent yellowish-brown (10YR 5/4) silt ~~loam~~ peds about 10 millimeters in diameter and 50 percent pale-brown (10YR 6/3) silt loam coatings 2 millimeters thick near the upper boundary to 10 millimeters thick near the lower boundary; weak, fine, subangular blocky structure; very friable; few fine roots; few, fine, dark-brown and black concretions; very strongly acid; abrupt, smooth boundary.

Bx1—23 to 38 inches, yellowish-brown (10YR 5/6 to 5/8) light silty clay loam; light brownish-gray (10YR 6/2) mottles; strong, very coarse, prismatic structure parting to weak, medium, angular blocky; firm, compact and brittle; light-gray silt coatings on peds; thick clay flows; few, fine to medium, black concretions; very strongly acid; gradual, smooth boundary.

Bx2—38 to 48 inches, mottled yellowish-brown (10YR 5/6), light brownish-gray (10YR 6/2), and strong-brown (7.5YR 5/8) light silty clay loam; medium and distinct mottles; strong, very coarse, prismatic structure parting to moderate, coarse, angular blocky; very firm, compact; common, medium, black concretions; very strongly acid; gradual, wavy boundary.

IIC—48 to 78 inches +, mottled yellowish-brown (10YR 5/6), light brownish-gray (10YR 6/2), and light yellowish-brown (2.5Y 6/4) silty clay loam; medium and distinct mottles; weak, coarse, blocky structure; friable to firm; common, medium, black concretions; a few sandstone fragments; very strongly acid.

The solum ranges from 40 to 70 inches in thickness, and depth to bedrock ranges from 50 to 100 inches. The profile is strongly acid or very strongly acid unless limed. Depth to the fragipan ranges from 18 to 28 inches.

The Ap horizon ranges from dark grayish brown (10YR 4/2) to light olive brown (2.5Y 5/4). The B2t horizon is yellowish-brown (10YR 5/4 or 5/6) or light olive-brown (2.5Y 54) silt loam or light silty clay loam. The B part of the B&A'2 horizon consists of the peds, which are yellowish-brown (10YR 5/4 or 5/6) or light olive-brown (2.5Y 5/4) silt loam or light silty clay loam. The A'2 part consists of the coatings, which range from pale-brown (10YR 6/3) to light-gray (10YR 7/2) silt loam or silt and make up 50 to 70 percent of the horizon. The Bx horizon ranges from strong brown (7.5YR 5/8) to olive brown (2.5Y 4/4) and is mottled with shades of gray or is mottled and does not have a dominant color. It is silt loam or silty clay loam. The C horizon has the same color as the Bx horizon. It ranges from silty clay loam to clay and from 1 to 35 percent coarse fragments, by volume.

Sadler soils are near Zanesville and Johnsburg soils. They differ from Zanesville soils in having an A' horizon above the fragipan. They are better drained than Johnsburg soils.

Sadler silt loam, 0 to 2 percent slopes (SaA).—This soil is on broad, smooth ridgetops. Areas range from 2 to 30 acres in size. This soil has the profile described as representative of the series. Included in mapping were a few small areas of Lawrence soils.

This Sadler soil is strongly acid or very strongly acid except where limed. It has a seasonal high water table at a depth of about 18 to 24 inches during winter and early in spring. It is easy to till except when wet early in spring.

This soil is suited to most of the row crops and hay and pasture plants commonly grown in the county. It is unsuitable for alfalfa. Tobacco is damaged by wetness in some years. (Capability unit IIw–2; woodland group 3w1)

Sadler silt loam, 2 to 6 percent slopes (SaB).—This soil is on ridgetops. Areas range from 2 to 40 acres in size. Included in mapping were a few small areas of Lawrence soils and areas of Sadler soils that have been eroded and have a thinner surface layer.

This Sadler soil is strongly acid or very strongly acid except where limed. It has a seasonal high water table at a depth of 18 to 24 inches during winter and early in spring.

This soil is suited to most of the row crops and hay and pasture plants commonly grown in the county. It is unsuitable for alfalfa. Erosion is a hazard. Soil-conserving practices are needed to slow runoff and reduce erosion. (Capability unit IIe–2; woodland group 3w1)

Steff Series

The Steff series consists of deep, moderately well drained soils on flood plains, in upland depressions, and in drainageways. These soils formed in acid alluvium washed from uplands underlain by sandstone, siltstone, and shale. Slopes range from 0 to 2 percent.

In a representative profile the surface layer is dark-brown silt loam about 8 inches thick. The subsoil extends to a depth of 38 inches. It is yellowish-brown silt loam in the upper 4 inches and pale-olive silt loam mottled with yellowish brown and light olive gray in the lower part. The substratum to a depth of 50 inches or more is light brownish-gray silt loam mottled with yellowish brown and gray.

Steff soils have a deep root zone and are moderately permeable. They are normally strongly acid, but the surface layer is less acid in places where it has been limed. Occasional flooding is a hazard during winter and spring.

These soils are used for crops, hay, and pasture.

Representative profile of Steff silt loam, 500 feet south of highway 1230 on south side of Rawhide Creek, 1.4 miles west of intersection with U.S. Highway 431, about 4 miles northwest of Lewisburg:

Ap—0 to 8 inches, dark-brown (10YR 4/3) silt loam; weak, fine, granular structure; very friable; many fine roots; strongly acid; clear, smooth boundary.

B1—8 to 12 inches, yellowish-brown (10YR 5/4) silt loam; weak, very fine, granular structure; very friable; many roots; strongly acid; clear, smooth boundary.

B2—12 to 38 inches, pale-olive (5Y 6/3) silt loam; common, medium, faint mottles of yellowish brown (10YR 5/6) and light olive gray (5Y 6/2); weak, fine, granular structure; friable; strongly acid; gradual, smooth boundary.

C—38 to 50 inches +, light brownish-gray (10YR 6/2) silt loam; common, medium, distinct mottles of yellowish-brown (10YR 5/4) and gray (10YR 5/1); massive; friable; strongly acid.

The solum ranges from 25 to 50 inches in thickness, and depth to sandstone bedrock ranges from 48 to 120 inches. The profile is strongly acid or very strongly acid unless limed. Content of gravel ranges from 0 to 5 percent in the upper 40 inches and 0 to 50 percent below.

The Ap horizon is dark brown (10YR 4/3) or dark grayish brown (10YR 4/2). The B1 horizon ranges from brown (10YR 4/3) to yellowish brown (10YR 5/4). The B2 horizon ranges from light brownish gray (10YR 6/2) to olive (5Y 5/4) and is mottled with shades of brown or gray. It is silt loam or light silty clay loam. The C horizon matrix and mottles are shades of brown and gray. This horizon is silt loam or loam. Some profiles are stratified with sandy loam and gravel below a depth of 50 inches.

Steff soils are near Cuba, Lindside, and Clifty soils. They are not so well drained as Cuba soils, are more strongly acid than Lindside soils, and are not so gravelly as Clifty soils.

Steff silt loam (0 to 2 percent slopes) (St).—This soil is on flood plains and in upland depressions and drainageways. Areas range from 5 to 15 acres in size. Included in mapping were small areas of Cuba, Lindside, and Clifty soils.

This Steff soil is generally strongly acid unless limed. It has a seasonal high water table at a depth of about 18 to 24 inches during winter and early in spring and is subject to occasional flooding during the same period. Erosion is not a hazard. The soil is easy to till.

This soil is suited to most of the row crops and hay and pasture plants commonly grown in the county. Some perennial plants, such as alfalfa, can be damaged by flooding and by the seasonal high water table. (Capability unit I–2; woodland group 1w1)

Talbott Series

The Talbott series consists of moderately deep and deep, well-drained, clayey soils on broad ridgetops and sides of ridges. These soils formed in material weathered from limestone. Slopes range from 2 to 50 percent.

In a representative profile the surface layer is brown silt loam about 6 inches thick. The subsoil extends to a depth of 40 inches. It is yellowish-red silty clay and clay in the upper 20 inches and mottled yellowish-brown and strong-brown clay in the lower part. Limestone bedrock is at a depth of about 40 inches.

Talbott soils have a moderately deep and deep root zone and are moderately slowly permeable. They are generally medium acid or strongly acid, but the surface layer is less acid where limed, and the material just above the limestone is less acid.

These soils are used for crops, hay, pasture, and trees.

Representative profile of Talbott silt loam, 6 to 12 percent slopes, 75 feet west of a gravel road, 0.2 mile north of intersection with U.S. Highway 68, 1 mile west of Auburn:

Ap—0 to 6 inches, brown (7.5YR 4/4) silt loam; weak, fine and medium, granular structure; friable, slightly sticky; many fine and medium roots; medium acid; abrupt, smooth boundary.

B21t—6 to 11 inches, yellowish-red (5YR 4/6) silty clay; reddish-brown (5YR 4/4) ped faces; moderate, medium, subangular blocky structure parting to very fine blocky; firm, sticky and plastic; common fine and medium roots; strongly acid; clear, smooth boundary.

B22t—11 to 26 inches, yellowish-red (5Y 4/6) clay; common, medium, distinct mottles of yellowish brown (10YR 5/4) and very dark brown (10YR 2/2); few vertical streaks of light brownish-gray (2.5Y 6/2) silt or very fine sand; few clean sand grains on ped faces; moderate, medium, angular blocky structure; very firm, very sticky and very plastic; continuous clay films; common roots; medium acid; gradual, wavy boundary.

B3t—26 to 40 inches, mottled yellowish-brown (10YR 5/8) and strong-brown (7.5YR 5/6) clay; strong, medium, angular blocky structure; very sticky and very plastic; continuous clay films; few, fine, black concretions; medium acid; abrupt, smooth boundary.

R—40 inches +, limestone.

The solum ranges from 24 to 60 inches in thickness and is underlain by limestone bedrock. The profile is generally medium acid or strongly acid, but the material just above the limestone rock is less acid, and the surface layer is less acid where limed.

The Ap horizon is brown (7.5YR 4/4), 7.5YR 5/4, or 10YR 4/3) or dark yellowish brown (10YR 4/4). It is mainly silt loam, but in eroded areas it is silty clay loam or silty clay.

The B2t horizon ranges from yellowish red (5YR 4/8) to reddish brown (2.5YR 4/4). It is mainly silty clay or clay, but the upper few inches in some places is heavy silty clay loam. The B3t horizon ranges from yellowish brown (10YR 5/8) to yellowish red (5YR 4/6) and in some places is mottled without a dominant color. It has moderate or strong, fine and medium, angular or subangular blocky structure. Some profiles have a C horizon that has the same color and texture as the B3 horizon.

Talbott soils are near Crider, Colbert, and Fredonia soils. They are shallower over bedrock than Crider soils and are redder and more clayey in the upper part of the subsoil. They are redder and better drained than Colbert soils. They are not so red as Fredonia soils and are commonly deeper over bedrock.

Talbott silt loam, 2 to 6 percent slopes (TaB).—This soil is on broad ridgetops. Areas range from 2 to 30 acres in size.

Included with this soil in mapping were small areas of Crider, Colbert, and Fredonia soils and small areas of eroded soils that have a surface layer of yellowish-red silty clay loam or silty clay.

This Talbott soil generally has a deep root zone, but in a few areas it has a moderately deep root zone. It is easy to till.

This soil is suited to most of the row crops and hay and pasture plants commonly grown in the county. Erosion is a hazard in cultivated areas, and soil-conserving practices therefore are needed to slow runoff and reduce erosion. (Capability unit IIe–5; woodland group 3c1)

Talbott silt loam, 6 to 12 percent slopes (TaC).—This soil is on narrow ridges and sides of ridges. Areas range from 5 to 20 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping were small areas of Crider, Colbert, and Fredonia soils and some areas of eroded soils that have a surface layer of yellowish-red silty clay loam or silty clay.

This Talbott soil generally has a deep root zone, but in a few areas it has a moderately deep root zone. It is easy to till.

This soil is suited to most of the row crops and hay and pasture plants commonly grown in the county. Erosion is a severe hazard in cultivated areas, and soil-conserving practices therefore are needed to slow runoff and reduce erosion. (Capability unit IIIe–7; woodland group 3c1)

Talbott silt loam, 12 to 20 percent slopes (TaD).—This soil is on narrow ridgetops, on sides of ridges, and around sinkholes in areas that have karst topography. Areas range from 5 to 20 acres in size.

Included with this soil in mapping were small areas of Colbert and Fredonia soils and small areas of eroded soils that have a surface layer of yellowish-red silty clay loam or silty clay.

This Talbott soil has a deep to moderately deep root zone. The large amount of surface runoff makes the soil somewhat droughty.

This soil is suited to most of the row crops and hay and pasture plants commonly grown in the county. It is suited to row crops only occasionally, because it is limited by the very severe hazard of erosion. Pasture should be managed to maintain good plant cover. Where row crops are grown, soil-conserving practices are needed to slow runoff and reduce erosion. (Capability unit IVe–3; woodland group 3c1)

Talbott silty clay, 6 to 20 percent slopes, severely eroded (TbD3).—This soil is on narrow ridgetops, on sides of ridges, and around sinkholes in areas of karst topography. Areas range from 2 to 5 acres in size. This soil has a profile similar to the one described as representative of the series, but the surface layer is yellowish-red silty clay.

Included with this soil in mapping were small areas of Colbert soils and small areas of soils that are 2 to 10 percent Rock outcrop.

This Talbott soil has a moderately deep, effective root zone. It has very low organic-matter content and low

natural fertility. The clayey surface layer makes seedbed preparation difficult. The large amount of runoff and the moderately deep root zone make the soil droughty.

This soil is unsuited to row crops because erosion is a hazard and tilth is poor. It is suited to pasture if plant cover can be maintained by applying fertilizer and limiting grazing. Some of the better suited grasses and legumes are Kentucky 31 fescue, Ladino clover, Korean lespedeza, and sericea lespedeza. (Capability unit VIe–1; woodland group 4c1)

Talbott-Colbert rocky silt loams, 2 to 20 percent slopes (TcD).—These closely intermingled soils are on narrow ridgetops and sides of ridges in areas dissected by small streams and drainageways. Areas range from 2 to 100 acres or more in size. Rock outcrop covers 2 to 10 percent of the surface area, and stones cover about 10 percent.

Talbott soils make up about 45 percent of this mapping unit, Colbert soils 30 percent, and other soils 25 percent. Also included were soils that are clayey and shallower over bedrock than Talbott soils.

The Talbott soil in this unit has a profile similar to the one described as representative of the Talbott series, but it is rocky, has stones on the surface, and is generally less than 40 inches deep over bedrock. The Colbert soil has a profile similar to the one described as representative of the Colbert series, but it also is rocky, has stones on the surface, and is shallower over bedrock.

The soils in this mapping unit have a moderately deep root zone and are droughty. They are mostly wooded, but a few areas are pastured. Drought-resistant plants, such as Kentucky 31 fescue, redtop, sweetclover, Korean lespedeza, and sericea lespedeza, are better suited than other pasture plants. Grazing should be limited in order to maintain enough plant cover for erosion control. (Capability unit VIs–1; woodland group 3x1)

Talbott-Colbert rocky silt loams, 20 to 50 percent slopes (TcF).—These soils are on hillsides in areas commonly dissected by deep drainageways. Areas range from 2 to more than 100 acres in size. Rock outcrop covers 2 to 10 percent of the surface, and stones cover about 10 percent.

The soils in this mapping unit are similar to those described under Talbott-Colbert rocky silt loams, 2 to 20 percent slopes.

Slope, rockiness, and droughtiness make these soils better suited to trees or wildlife habitat than to other uses. Pasture plants are difficult to establish and maintain. (Capability unit VIIs–1; woodland group 3x2)

Wellston Series

The Wellston series consists of deep, well-drained soils on ridgetops and sides of ridges. These soils formed in a mantle of loess and in material weathered from sandstone, siltstone, and shale. Slopes range from 2 to 12 percent.

In a representative profile the surface layer is brown silt loam about 12 inches thick. The subsoil extends to a depth of 38 inches. It is strong-brown silty clay loam that contains some coarse fragments and is mottled with yellowish brown in the lower part. The substratum is yellowish-red channery silty clay loam mottled with yellowish brown to a depth of 41 inches. It contains weathered sandstone fragments. Sandstone and siltstone, weakly consolidated bedrock, is at a depth of about 41 inches and extends to a depth of 60 inches or more. This material becomes harder with depth.

Wellston soils have a deep root zone and are moderately permeable. They are generally strongly acid, but the surface layer is less acid where limed.

These soils are used for crops, hay, and pasture.

Representative profile of Wellston silt loam, 2 to 6 percent slopes, 150 feet west of farmhouse that is on a private road 0.3 mile west of State Highway 675, entrance to private road is 2.7 miles north of intersection with State Highway 103 and about 4 miles north of Auburn:

Ap—0 to 12 inches, brown (10YR 5/3) silt loam; weak, fine, granular structure; friable; many roots; strongly acid; clear, smooth boundary.

B2t—12 to 27 inches, strong-brown (7.5YR 5/6) light silty clay loam; moderate, medium, subangular blocky structure; friable; common fine roots; continuous thin clay films; strongly acid; clear, smooth boundary.

IIB3t—27 to 38 inches, strong-brown (7.5YR 5/6) silty clay loam; few, distinct, fine mottles of yellowish brown (10YR 5/4 and 5/6); moderate, fine, subangular and angular blocky structure; firm; few roots; nearly continuous clay films; 1 percent, by volume, weathered sandstone fragments less than 3 inches in diameter; strongly acid; gradual, wavy boundary.

IIC—38 to 41 inches, yellowish-red (5YR 5/6) channery silty clay loam; common, fine, distinct mottles of yellowish brown (10YR 5/4 and 5/6); moderate, medium, subangular blocky structure; firm; nearly continuous clay films; 20 percent, by volume, weathered sandstone fragments; strongly acid; gradual, wavy boundary.

R—41 to 60 inches +, brownish-yellow (10YR 6/6), weakly consolidated sandstone and siltstone bedrock; rock becomes harder with depth.

The solum ranges from 32 to 56 inches in thickness, and depth to sandstone, siltstone, and shale bedrock ranges from 40 to 72 inches. The profile is strongly acid or very strongly acid unless limed. Content of coarse fragments ranges from 0 to 30 percent in the B horizon, but averages less than 5 percent. Content of coarse fragments ranges from 15 to 70 percent in the C horizon.

The Ap horizon ranges from brown (10YR 5/3) to dark grayish brown (10YR 4/2). The B horizon ranges from dark yellowish-brown (10YR 4/4) to strong-brown (7.5YR 5/8) silt loam or silty clay loam. It has moderate, fine and medium, subangular blocky structure. The C horizon matrix and mottle colors range from yellowish brown (10YR 5/4) to yellowish red (5YR 5/6). Texture is loam, silt loam, silty clay loam, and clay loam and their channery analogues.

Wellston soils are near Zanesville, Frondorf, and Linker soils. They are better drained than Zanesville soils and do not have a fragipan. They are deeper than Frondorf soils and have fewer coarse fragments. They are more silty and less sandy in the upper part of the subsoil than Linker soils and are typically deeper over bedrock.

Wellston silt loam, 2 to 6 percent slopes (WeB).—This soil is on broad ridgetops. Areas range from about 4 to 20 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping were areas of Frondorf, Zanesville, and Linker soils and small areas of eroded soils that have a strong-brown surface layer and a few shallow gullies and rills.

This Wellston soil is generally strongly acid and has low organic-matter content and moderate natural fertility. Applications of lime and fertilizer make this soil much more suitable for crops. It is easy to till.

This soil is suited to most of the row crops and hay and pasture plants commonly grown in the county. Erosion is a hazard in cultivated areas. Soil-conserving practices therefore are needed to slow runoff and reduce erosion. (Capability unit IIe-1; woodland group 2o1)

Wellston silt loam, 6 to 12 percent slopes (WeC).—This soil is on the tops and upper sides of ridges. Areas range from 6 to 40 acres in size. This soil has a profile similar to the one described as representative of the series, but the surface layer is thinner.

Included with this soil in mapping were some small areas of Frondorf, Zanesville, and Linker soils. Also included were numerous shallow gullies and some areas of severely eroded soils that have a surface layer of strong-brown clay loam. These areas are identified on the soil map by a spot symbol.

This Wellston soil is generally strongly acid and has low organic-matter content and moderate natural fertility. Applications of lime and fertilizer make this soil much more suitable for crops. It is easy to till.

This soil is suited to most of the row crops and hay and pasture plants grown in the county. Erosion is a severe hazard in cultivated areas, and soil-conserving measures therefore are needed to slow runoff and reduce erosion. (Capability unit IIIe-1; woodland group 2o1)

Zanesville Series

The Zanesville series consists of well drained to moderately well drained soils on broad ridgetops and sides of ridges. These soils have a compact fragipan in the subsoil. They formed in a mantle of loess and in the underlying material weathered from sandstone, siltstone, and shale. Slopes range from 2 to 12 percent.

In a representative profile the surface layer is grayish-brown silt loam about 8 inches thick. The subsoil extends to a depth of 48 inches. The upper 20 inches is strong-brown heavy silt loam; the middle 9 inches is a compact fragipan of yellowish-brown light silty clay loam mottled with light gray and strong brown; and the lower part is strong-brown silty clay mottled with pale brown and yellowish red. The substratum to a depth of 72 inches or more is mottled strong-brown, yellowish-red, and grayish-brown silty clay.

Zanesville soils have a moderately deep root zone. They are moderately permeable in the upper part and slowly permeable in the fragipan, which is at a depth of 25 to 32 inches. They are strongly acid or very strongly acid, but the surface layer is less acid in places where it has been limed.

These soils are used for crops, hay, and pasture.

Representative profile of Zanesville silt loam, 2 to 6 percent slopes, 75 feet south of an unimproved road and 0.75 mile west of State Highway 675, entrance to the unimproved road is 2.9 miles north of intersection with State Highway 103 and about 4.2 miles north of Auburn:

Ap—0 to 8 inches, grayish-brown (10YR 5/2) silt loam; weak, fine, granular structure; very friable; common roots; strongly acid; abrupt, smooth boundary.

B2t—8 to 28 inches, strong-brown (7.5YR 5/6) heavy silt loam; moderate, medium, subangular blocky structure; friable; few fine roots; common clay films on ped faces; very strongly acid; clear, wavy boundary.

Bx—28 to 37 inches, yellowish-brown (10YR 5/4) light silty clay loam: many, medium, distinct mottles of light gray (10YR 7/2) and strong brown (7.5YR 5/6); strong, very coarse, prismatic structure parting to weak, medium, subangular blocky; firm, compact and brittle; common silt and clay coatings on ped faces; very strongly acid; gradual, smooth boundary.

IIB2t—37 to 49 inches, strong-brown (7.5YR 5/6) silty clay; common, coarse, distinct mottles of pale brown (10YR 6/3) and yellowish red (5YR 4/8); moderate, medium, angular blocky structure; firm; very strongly acid; clear, wavy boundary.

IIC—49 to 72 inches +, mottled strong-brown (7.5YR 5/6), yellowish-red (5YR 4/8), and grayish-brown (10YR 5/2) silty clay; massive; firm; 10 percent soft, weathered, sandstone and siltstone fragments in lower part; very strongly acid.

The solum ranges from 34 to 60 inches in thickness, and depth to sandstone, siltstone, or shale bedrock ranges from 40 to 80 inches. The profile is strongly acid or very strongly acid unless limed. Content of coarse fragments ranges from 0 to 12 percent in the solum and 5 to 50 percent below. Depth to the fragipan ranges from 25 to 32 inches.

The Ap horizon ranges from brown (10YR 4/3) to grayish brown (10YR 5/2). The B2t horizon ranges from brown (7.5YR 4/4) to yellowish-red (5YR 5/6) silt loam or light silty clay loam. The Bx horizon ranges from yellowish brown (10YR 5/4) to strong brown (7.5YR 5/6) and has few to many mottles in shades of gray and brown. It is silt loam or silty clay loam. The IIB2t and IIC horizon matrix and mottle colors range from yellowish red (5YR 4/8) to gray (10YR 6/1). These horizons range from loam to silty clay.

Zanesville soils are near Wellston, Frondorf, and Sadler soils. They are not so well drained as Wellston and Frondorf soils, which do not have a fragipan. They contain fewer coarse fragments and are deeper over bedrock than the Frondorf soils. They have redder hues in the subsoil and are slightly deeper over a fragipan than Sadler soils, which also have an A′ horizon above the fragipan.

Zanesville silt loam, 2 to 6 percent slopes (ZaB).—This soil is on broad ridgetops. Areas range from 10 to 100 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping were small areas of Sadler, Frondorf, and Wellston soils and small areas of eroded soils that have a brown surface layer and a few shallow gullies and rills.

This Zanesville soil has moderate natural fertility and low organic-matter content. It is easy to till.

This soil is suited to most of the row crops and hay and pasture plants commonly grown in the county. The life of alfalfa is generally only about 3 years because the root zone is moderately deep and the seasonal high water table is at a depth of about 2 to 2½ feet late in winter and early in spring. Erosion is a moderate hazard. Where row crops are grown, soil-conserving practices are needed to slow runoff and reduce erosion. (Capability unit IIe-3; woodland group 3o1)

Zanesville silt loam, 6 to 12 percent slopes (ZaC).—This soil is on upper sides of ridges that are below broad ridgetops. Areas range from 10 to 50 acres in size. This soil has a profile similar to the one described as representative of the series, but the surface layer is generally only 5 or 6 inches thick.

Included with this soil in mapping were small areas of Wellston and Frondorf soils. Also included were small areas of severely eroded soils that have a surface layer of strong-brown silty clay loam and a few shallow gullies and rills. These areas are identified on the soil map by a spot symbol.

This Zanesville soil has moderate natural fertility and low organic-matter content. It is easy to till.

This soil is suited to most of the cultivated crops and hay and pasture plants commonly grown in the county. The life of alfalfa is generally only 3 or 4 years because the root zone is moderately deep and the seasonal high water table is at a depth of about 2 to 2½ feet late in winter and early in spring. Erosion is a severe hazard in cultivated areas. Soil-conserving measures are needed to slow runoff and reduce erosion. (Capability unit IIIe-4); woodland group 3o1)

Use and Management of the Soils

This section contains information on how the soils of Logan County respond to management and how they can be used. On the pages that follow is information on crops and pasture, woodland, wildlife, engineering works, and town and country planning.

Use of the Soils for Crops and Pasture [2]

This section is a general guide to the suitability and management of the soils for crops and pasture. No specific management is suggested. Suggestions for the use of each soil are given in the section "Descriptions of the Soils."

This section has three main parts. In the first part some general principles of soil management are described. In the second part the capability grouping is explained. In the third, estimates of yields for suitable crops are given for each of the soils under both high and medium levels of management.

General principles of soil management

Some principles of management are general enough to apply to all the soils suitable for farm crops and pasture throughout the county, although the individual soils or groups of soils require different kinds of management. These general principles are described in the following paragraphs.

Many soils in the county require additions of lime, fertilizer, or both. The amounts needed depend on the natural content of lime and plant nutrients, which is determined by laboratory analyses of soil samples, by previous cropping and management, by the general requirements of the crop, and by the level of yields desired. Only general suggestions for applications of lime and fertilizer are made in this survey.

Most of the soils of Logan County are naturally low in organic-matter content, and it is not economical to build up the content to a high level. It is important, however, to return organic matter to the soil by adding farm manure, by leaving plant residue on the surface, and by growing sod crops, cover crops, and green-manure crops.

Tillage is needed to prepare a seedbed and control weeds, but should be kept to a minimum because it tends to break down soil structure. Maintaining the organic-matter content of the plow layer also helps to prevent breakdown of the soil structure.

On wet soils, such as Newark silt loam, yields of cultivated crops can be increased by surface or subsurface drainage. Subsurface tile drains are costly to install, but they generally provide better drainage than open ditches. Soils that have a fragipan are difficult to drain, but they can generally be drained better by open ditches than by tile lines. Open ditches are more effective if they intercept the water as it moves horizontally on top of the fragipan. Suitable outlets are needed for drainage by either tile or open ditches.

All of the gently sloping and steeper cultivated soils in Logan County are subject to erosion. Runoff and erosion occur mostly while the crop is growing or soon after it has been harvested. On erodible soils, such as Pembroke silt loam, 2 to 6 percent slopes, a suitable cropping system and other erosion-control practices are needed. In a suitable cropping system, crops are grown in proper sequence, under management that includes minimum tillage, mulch planting, use of crop residue, growing of cover crops and green-manure crops, and use of lime and fertilizer. Other erosion-control practices are contour cultivating, terracing, contour stripcropping, diverting runoff, and using grassed waterways. The effectiveness of a particular combination of these measures differs from one soil to another, but different combinations can be equally effective on the same soil. The local representative of the Soil Conservation Service can assist in planning an effective combination of practices.

Pasture is effective in controlling erosion on all but a few of the erodible soils in the county. A high level of pasture management is needed on some soils to provide enough ground cover to keep the soil from eroding. A high level of pasture management provides for fertilization, control of grazing, selection of pasture mixtures, and other practices that are adequate for maintaining good ground cover and forage for grazing. Grazing is controlled by rotating the livestock from one field to another and by providing rest periods for the pasture after each grazing period to allow for regrowth of the plants. It is important on some soils to select pasture mixtures that require the least amount of renovation to maintain good ground cover and forage for grazing.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The grouping is based on limitations of soils when they are used for field crops, the risk of damage when they are farmed, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops that require special management.

[2] Dentis A. Colson, conservation agronomist, Soil Conservation Service, helped prepare this section.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or for engineering.

In the capability system, all kinds of soil are grouped at three levels: the capability class, the subclass, and the unit.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use.

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by w, s, and c, because the soils in class V are subject to little or no erosion, although they have other limitations that restrict their use largely to pasture, range, woodland, wildlife habitat, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-4 or IIIe-6. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

In the following list the capability classes, the subclasses, and the units in Logan County are described. The unit designation for each soil is given in the Guide to Mapping Units.

Class I soils have few limitations that restrict their use (no subclasses).

- Unit I-1. Deep, nearly level, well-drained silt loams that are flooded occasionally; on flood plains and in upland depressions.
- Unit I-2. Deep, nearly level, moderately well drained silt loams that are flooded occasionally; on flood plains and in upland depressions.
- Unit I-3. Deep, nearly level, well-drained silt loams on uplands and stream terraces.

Class II soils have moderate limitations that reduce the choice of plants or require moderate conservation practices.

Subclass IIe. Soils subject to moderate erosion unless protected.

- Unit IIe-1. Deep, gently sloping, well-drained silt loams on uplands and stream terraces.
- Unit IIe-2. Deep, gently sloping, moderately well drained silt loams that have a fragipan or slowly permeable clay layers; on uplands.
- Unit IIe-3. Deep, gently sloping, well drained to moderately well drained silt loams that have a fragipan; on uplands.
- Unit IIe-4. Deep, gently sloping, well-drained loams on uplands.
- Unit IIe-5. Mostly deep, gently sloping, well-drained silt loams that have a clayey subsoil; on uplands.

Subclass IIw. Soils moderately limited by excessive wetness.

- Unit IIw-1. Deep, nearly level, somewhat poorly drained silt loams that are occasionally flooded; on flood plains.
- Unit IIw-2. Deep, nearly level, moderately well drained silt loams that have a fragipan; on uplands.

Subclass IIs. Soils limited because they are gravelly and droughty.

- Unit IIs-1. Deep, nearly level, well-drained gravelly silt loams that are flooded occasionally; on flood plains.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Subclass IIIe. Soils subject to severe erosion if they are cultivated and not protected.

- Unit IIIe-1. Deep, sloping, well-drained silt loams on uplands and terraces.
- Unit IIIe-2. Deep, sloping, well-drained cherty silt loams on uplands.
- Unit IIIe-3. Deep, sloping, moderately well drained silt loams that have a fragipan or slowly permeable clayey layer; on uplands.
- Unit IIIe-4. Deep, sloping, well drained to moderately well drained silt loams that have a fragipan; on uplands.
- Unit IIIe-5. Deep, sloping, well-drained loams on uplands.
- Unit IIIe-6. Moderately deep, sloping, well-drained silt loams on uplands.
- Unit IIe-7. Mostly deep, sloping, well-drained silt loams that have a clayey subsoil; on uplands.

Subclass IIIw. Soils severely limited by excessive wetness.

- Unit IIIw-1. Deep, nearly level, poorly drained silt loams that are subject to flooding and have a seasonal high water table; on flood plains.
- Unit IIIw-2. Deep, nearly level, somewhat poorly drained silt loams that have a fragipan and a seasonal high water table; on uplands and stream terraces.
- Unit IIIw-3. Deep, level or depressed areas of very poorly drained to poorly drained, silty clays and silty clay loams that are subject to

flooding and have a seasonal high water table; on flood plains.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Subclass IVe. Soils subject to very severe erosion if they are cultivated and not protected.

Unit IVe-1. Deep, strongly sloping, well-drained cherty silt loams on uplands.

Unit IVe-2. Moderately deep, strongly sloping, well-drained silt loams underlain by sandstone; on uplands.

Unit IVe-3. Moderately deep to deep, strongly sloping, well-drained silt loams that have a clayey subsoil; on uplands.

Unit IVe-4. Moderately deep to deep, sloping, moderately well drained silt loams that have a clayey subsoil; on uplands.

Unit IVe-5. Deep, sloping, well-drained, severely eroded silty clay loams on uplands.

Unit IVe-6. Deep, sloping, well-drained, severely eroded cherty silty clay loams on uplands.

Subclass IVw. Soils very severely limited by excessive wetness.

Unit IVw-1. Deep, nearly level, poorly drained silt loams that have a fragipan and a seasonal high water table; on stream terraces and uplands.

Class V soils are subject to little or no erosion but have other limitations, impractical to remove, that limit their use largely to pasture, woodland, or wildlife habitat. (None in Logan County.)

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture, woodland, or wildlife habitat.

Subclass VIe. Soils severely limited, mainly by hazard of erosion, unless protective cover is maintained.

Unit VIe-1. Moderately deep to deep, sloping and strongly sloping, well-drained, severely eroded silty clays on uplands.

Unit VIe-2. Moderately deep to deep, sloping, moderately well drained, severely eroded silty clays on uplands.

Subclass VIs. Soils very severely limited by rockiness or stoniness, depth, and droughtiness.

Unit VIs-1. Moderately deep, gently sloping to strongly sloping, well drained to moderately well drained rocky or stony loams, silt loams, and silty clay loams on uplands.

Class VII soils have severe limitations that make them unsuited to cultivation and restrict their use largely to limited pasture, woodland, or wildlife habitat.

Subclass VIIe. Soils and land types very severely limited, mainly by hazard of erosion.

Unit VIIe-1. Very severely eroded soils and an intricate pattern of gullies, 1 to 5 feet deep.

Subclass VIIs. Soils and land types very severely limited by rockiness or stoniness, slope, depth, and droughtiness.

Unit VIIs-1. Moderately deep, strongly sloping to steep, well drained and moderately well drained rocky or stony silt loams on uplands.

Unit VIIs-2. Rock outcrop and moderately deep, mostly moderately steep and steep soils on uplands.

Class VIII soils and landforms have limitations that preclude their use for commercial crop production and restrict their use to recreation, wildlife habitat, water supply, or esthetic purposes. (None in Logan County.)

Estimated yields

Table 2 shows the estimated average yields for the crops most commonly grown in Logan County, under two levels of management. Yields to be expected under a medium level of management are in columns A, and yields under a high level of management are in columns B.

Yields shown are the average that can be expected over a period of several years. Yields for one year can be adversely affected by extremes of weather or by insects, disease, or some other disaster; or the yields can be extremely high because conditions are unusually favorable.

A comparison of the yields in columns A with those in columns B shows the differences that can be expected by improving management. No medium-level yields are shown for tobacco because a high level of management is nearly always used for that crop.

A high level of management consists of (1) the use of adapted, recommended varieties of plants; (2) proper seeding rates, inoculation of legumes, timely planting, and efficient harvesting methods; (3) control of weeds, insects, and plant disease; (4) fertilizer application equal to or more than the current recommendations of the University of Kentucky Agricultural Experiment Station or equal to or more than the need shown by properly interpreted soil tests; (5) adequate applications of lime; (6) drainage for naturally wet soils, where feasible; (7) cropping systems that control erosion and maintain soil structure, tilth, and organic-matter content; (8) the use of erosion-control practices, such as minimum tillage, interseeding winter crops and row crops, contour tillage, terracing, contour stripcropping, and sod waterways; (9) use of cover crops, crop residue, or both to increase organic-matter content and control erosion; (10) use of all applicable management practices for pasture; and (11) use of other practices suggested by representatives of the Soil Conservation Service and the Agricultural Extension Service in this county.

A high-level yield is not considered the maximum yield possible, but it is one that many farmers find practical to maintain if they apply the proper practices. It is a level of management that will result in the highest sustained production that is economically feasible.

Under a medium level of management the fertilization and management are those generally considered as the minimum that will keep the soil from deteriorating and produce sufficient crops for some profit.

The failure to use one or more of the practices listed for a high level of management can cause production levels to drop below the profit margin and can also result in some permanent damage to the soil. Inadequate drainage or only partial application of runoff- and erosion-control practices are examples of inadequate management.

TABLE 2.—*Estimated average acre yields of principal crops*

[Yields in columns A are those expected under medium-level management; yields in columns B are those to be expected under high-level management. Absence of a figure indicates that the soil is considered unsuitable for the crop or the crop is not commonly grown on the soil]

Soil	Corn		Wheat		Barley		Soybeans		Tobacco	Hay: Alfalfa and grass		Hay: Red clover and grass		Pasture (tall grasses and legumes)	
	A	B	A	B	A	B	A	B	B	A	B	A	B	A	B
	Bu	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Lb*	*Tons*	*Tons*	*Tons*	*Tons*	*Cow-acre-days* [1]	*Cow-acre-days* [1]
Allegheny loam, 2 to 6 percent slopes	90	130	40	60	50	75	35	45	2, 600	4. 0	5. 5	3. 0	4. 0	175	255
Allegheny loam, 6 to 12 percent slopes	70	90	25	30	40	60	25	30	2, 200	4. 0	5. 5	3. 0	4. 0	175	230
Allegheny stony loam, 12 to 20 percent slopes												2. 5	3. 0	150	200
Baxter cherty silt loam, 6 to 12 pcerent slopes	70	90	35	40	45	60	25	35	2, 300	4. 0	5. 5	3. 0	4. 0	175	230
Baxter cherty silt loam, 12 to 20 percent slopes	60	70	25	30	40	55	20	30	1, 750	3. 0	4. 5	3. 0	3. 5	150	200
Baxter cherty silty clay loam, 6 to 12 percent slopes, severely eroded	50	70	20	30	30	45	20	25	1, 600	2. 5	3. 5	1. 5	2. 5	100	145
Bonnie silt loam	75	95					25	35				2. 5	3. 5	175	230
Clifty gravelly silt loam	50	70					20	25				3. 0	4. 0	200	285
Colbert silt loam, 6 to 12 percent slopes	40	50	15	20	40	60	20	25		2. 5	3. 5	2. 0	3. 0	150	230
Colbert silty clay, 6 to 12 percent slopes, severely eroded										2. 0	2. 5	2. 0	2. 5	100	145
Crider silt loam, 0 to 2 percent slopes	115	150	40	55	65	90	35	50	3, 200	5. 0	5. 5	3. 0	4. 0	200	255
Crider silt loam, 2 to 6 percent slopes	100	140	40	55	60	85	35	45	3, 200	5. 0	5. 5	3. 0	4. 0	200	255
Crider silt loam, 6 to 12 percent slopes	100	125	40	50	50	75	30	40	2, 900	5. 0	5. 5	3. 0	4. 0	200	255
Cuba silt loam	115	150	40	55	65	90	35	50	3, 050	4. 0	5. 5	3. 0	4. 0	200	285
Cumberland silt loam, 2 to 6 percent slopes	100	140	40	55	60	85	35	45	3, 200	4. 0	5. 5	3. 0	4. 0	200	255
Cumberland silt loam, 6 to 12 percent slopes	100	125	40	50	50	75	30	40	2, 900	4. 0	5. 5	3. 0	4. 0	175	250
Cumberland silty clay loam, 6 to 12 percent slopes, severely eroded	65	90	25	40	40	60	25	30	2, 000	3. 0	3. 5	1. 5	2. 5	120	165
Dunning silty clay loam	95	135	35	45	50	75	35	45		3. 5	4. 5	3. 0	4. 0	175	230
Elk silt loam, 0 to 2 percent slopes	115	150	40	55	65	90	35	50	3, 200	4. 0	5. 5	3. 0	4. 0	200	255
Elk silt loam, 2 to 6 percent slopes	100	140	40	55	60	85	35	45	3, 200	4. 0	5. 5	3. 0	4. 0	200	255
Elk silt loam, 6 to 12 percent slopes	100	125	40	50	50	75	30	40	2, 900	4. 0	5. 5	3. 0	4. 0	200	255
Epley silt loam, 2 to 6 percent slopes	80	115	30	40	45	65	30	35	2, 400	2. 5	4. 0	2. 5	3. 5	180	215
Epley silt loam, 6 to 12 percent slopes	70	90	25	30	40	60	25	30	2, 200	2. 5	3. 5	2. 2	3. 0	160	190
Fredonia rocky silty clay loam, 2 to 12 percent slopes										2. 5	3. 0	2. 0	3. 0	110	150
Frondorf silt loam, 6 to 12 percent slopes	70	90	25	30	40	60	25	30	2, 200	2. 5	3. 5	2. 5	3. 0	160	230
Frondorf silt loam, 12 to 20 percent slopes												2. 0	2. 5	150	230
Frondorf stony complex, 12 to 50 percent slopes														115	150
Hartsells loam, 6 to 12 percent slopes	70	90	25	30	40	60	25	30	2, 200	3. 0	3. 5	2. 5	3. 0	160	200
Johnsburg silt loam	55	85					20	30				2. 5	3. 0	150	230
Karnak silty clay	75	95					25	35				2. 5	3. 0	175	230
Lawrence silt loam	55	85					20	30				2. 0	3. 0	160	185
Lindside silt loam	100	135	30	40	65	90	30	45	2, 900	5. 0	7. 0	3. 0	5. 0	190	260
Linker loam, 2 to 6 percent slopes	90	130	40	60	50	75	35	45	2, 600	4. 0	5. 0	3. 0	4. 0	175	230
Linker loam, 6 to 12 percent slopes	70	90	25	30	40	60	25	30	2, 200	4. 0	5. 0	3. 0	3. 5	175	230
Melvin silt loam	75	95					25	35				2. 5	3. 5	175	230
Newark silt loam	100	140	25	30	35	55	35	45	2, 500	3. 5	4. 5	3. 0	4. 0	175	230
Nicholson silt loam, 0 to 2 percent slopes	70	105	25	30	35	55	30	35	2, 300	3. 5	4. 5	3. 0	4. 0	180	230
Nicholson silt loam, 2 to 6 percent slopes	90	125	35	45	55	80	30	35	2, 500	4. 0	5. 0	3. 0	4. 0	180	230
Nicholson silt loam, 6 to 12 percent slopes	75	90	30	35	40	60	25	35	2, 250	3. 5	4. 5	3. 0	3. 5	180	230
Nolin silt loam	115	150	40	55	65	90	35	50	3, 050	4. 0	5. 5	3. 0	4. 0	200	285
Pembroke silt loam, 0 to 2 percent slopes	115	150	40	55	65	90	35	50	3, 200	4. 0	5. 5	3. 0	4. 0	200	255
Pembroke silt loam, 2 to 6 percent slopes	110	140	40	55	65	90	35	45	3, 200	4. 0	5. 5	3. 0	4. 0	200	255

See footnote at end of table.

TABLE 2.—*Estimated average acre yields of principal crops*—Continued

Soil	Corn		Wheat		Barley		Soybeans		Tobacco	Hay				Pasture (tall grasses and legumes)	
										Alfalfa and grass		Red clover and grass			
	A	B	A	B	A	B	A	B	B	A	B	A	B	A	B
	Bu	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Lb*	*Tons*	*Tons*	*Tons*	*Tons*	*Cow-acre-days* [1]	*Cow-acre-days* [1]
Pembroke silt loam, 6 to 12 percent slopes	100	125	40	50	50	75	30	40	2, 900	4. 0	5. 5	3. 0	4. 0	200	255
Pembroke silty clay loam, 6 to 12 percent slopes, severely eroded	65	90	25	40	40	60	25	30	2, 100	3. 0	4. 0	2. 0	3. 0	125	165
Pickwick silt loam, 2 to 6 percent slopes	100	140	40	55	65	90	35	45	3, 200	5. 0	7. 0	3. 0	5. 0	185	250
Pickwick silt loam, 6 to 12 percent slopes	100	125	40	50	50	75	30	40	2, 900	4. 0	6. 0	3. 0	4. 5	160	220
Pickwick silty clay loam, 6 to 12 percent slopes, severely eroded	65	90	25	40	40	60	25	30	2, 000	3. 0	4. 0	2. 0	3. 0	150	190
Robertsville silt loam	40	60	----	----	----	----	20	25	----	----	----	----	----	150	200
Sadler silt loam, 0 to 2 percent slopes	70	105	25	30	35	55	30	35	2, 300	2. 0	3. 0	2. 5	3. 5	180	215
Sadler silt loam, 2 to 6 percent slopes	80	115	30	40	45	65	30	35	2, 400	2. 5	4. 0	2. 5	3. 5	180	215
Steff silt loam	100	135	30	40	65	90	30	45	2, 900	4. 0	5. 5	3. 0	4. 0	200	285
Talbott silt loam, 2 to 6 percent slopes	90	125	35	40	50	75	25	30	2, 800	4. 0	5. 0	3. 0	3. 5	150	230
Talbott silt loam, 6 to 12 percent slopes	40	50	25	35	40	60	20	25	2, 000	3. 0	3. 5	2. 5	3. 0	150	230
Talbott silt loam, 12 to 20 percent slopes	----	----	----	----	----	----	----	----	----	3. 0	3. 5	2. 5	3. 0	150	230
Talbott silty clay, 6 to 20 percent slopes, severely eroded	----	----	----	----	----	----	----	----	----	2. 0	2. 5	1. 0	2. 0	90	145
Talbott-Colbert rocky silt loams, 2 to 20 percent slopes	----	----	----	----	----	----	----	----	----	2. 5	3. 0	1. 5	2. 0	100	150
Talbott-Colbert rocky silt loams, 20 to 50 percent slopes	----	----	----	----	----	----	----	----	----	----	----	----	----	100	150
Wellston silt loam, 2 to 6 percent slopes	100	140	40	55	65	90	35	45	3, 200	4. 0	5. 5	3. 0	4. 0	195	250
Wellston silt loam, 6 to 12 percent slopes	100	125	40	50	50	75	30	40	2, 900	4. 0	5. 5	3. 0	4. 0	195	250
Zanesville silt loam, 2 to 6 percent slopes	90	125	35	45	55	80	30	35	2, 500	3. 0	4. 5	3. 0	3. 5	175	230
Zanesville silt loam, 6 to 12 percent slopes	75	90	30	35	40	60	25	35	2, 250	3. 0	4. 0	2. 5	3. 0	175	230

[1] The number of days that 1 acre will support 1 animal unit (1 cow, 1 steer, or 1 horse; 5 hogs; or 7 sheep or goats) without injury to the pasture. For example, an acre of pasture that provides grazing for 2 cows for 100 days has a capacity of 200 cow-acre-days.

Use of the Soils as Woodland [3]

This section describes the woodland of Logan County and explains the woodland grouping of soils. In table 3, the woodland groups are defined, the potential yields are estimated, and suitable tree species are listed. Table 3 also lists factors that limit the management of each woodland group.

When Logan County was formed in 1792, most of the land was covered with hardwood forest. The dominant tree species were oak, yellow-poplar, hickory, black walnut, beech, gum, and cottonwood. The original forest was generally logged without regard to silvicultural requirements of tree species. The best quality species commonly were removed first. Forests were often cleancut for farming and later abandoned because of low productivity. The abandoned land reverted naturally to forest. Today approximately 109,300 acres of forest occupies steep, shallow soils on streambanks and in poorly drained areas or occurs as scattered, small woodlots on most farms.

Several major forest types are represented in Logan County. *The oak-hickory type* is mainly scarlet oak, black oak, white oak, and hickory. Major soils associated with this forest type are of the Baxter, Colbert, Frondorf, Cumberland, and Zanesville series. *The central-mixed hardwood type* is mainly yellow-poplar, maple, beech, basswood, black walnut, elm, and northern red oak. Major soils associated with this forest type are of the Allegheny, Elk, Pickwick, Wellston, Baxter, Crider, Pembroke, Nolin, and Cumberland series. *The redcedar-hardwood type* consists of scarlet oak, black oak, white oak, redcedar, and hickory. The major soils associated with this forest type are of the Colbert, Talbott, Fredonia, and Frondorf series. *The white oak type* is 50 percent or more white oak. Soils associated with this type are of the Baxter, Frondorf, Zanesville, Talbott, and Fredonia series. *The elm-ash-cottonwood type* is associated with soils of the Lindside, Newark, and Nolin series.

[3] CHARLES FOSTER, staff forester, Soil Conservation Service, helped prepare this section.

In the past, local markets provided outlets for rough lumber, pallets, and furniture stock. Market outlets have been generally poor for the low-grade hardwoods. At present about one-third of the commercial forest in the county is well stocked with merchantable or potentially merchantable trees. Many sites have the potential to produce 50 or more cubic feet of wood per acre per year. Improved woodland management practices and improved fire protection and grazing control are needed if this potential is to be realized.

Woodland groupings

The soils of Logan County have been grouped according to their suitability for the principal tree species and their limitations for use as woodland. In this classification system soils are grouped at three levels: the class, the subclass, and the group.

WOODLAND CLASSES, the broadest groupings, are designated by Arabic numerals 1 to 6. Woodland classes indicate productivity and are determined by the average site index of an indicator tree species on soils in the group. Class 1 produces the highest yields, and class 6, the lowest.

WOODLAND SUBCLASSES are divisions within a class. They are designated by adding a small letter, *x*, *w*, *t*, *d*, *c*, *s*, *f*, *r*, or *o*, to the class numeral; for example, 3w. These subclasses are based on soil properties that are important limitations to management of woodland. The letter *x* shows that the soil is restricted or limited by stones or rocks. The letter *w* shows that excessive wetness, either seasonal or year-long, significantly limits use of the soil for woodland; soils in this subclass have restricted drainage or a fluctuating to permanently high water table or a flood hazard that adversely affects stand development or management. The letter *t* indicates that the soil has excessive alkalinity, acidity, sodium salts, or other toxic substances within the root zone that limit or impede the development and functioning of root systems of desirable tree species. The letter *d* shows that the soil is restricted or limited by a restricted root zone. The letter *c* indicates that the soil is restricted or limited by the kind and amount of clay in the profile. The letter *s* means that the soil is restricted or limited for woodland by the amount of coarse-textured material in the profile. The letter *f* shows the soil is restricted or limited by fragments from 2 millimeters to stone size in diameter. The letter *r* indicates that slope is the only limitation. The letter *o* means the soil has no significant restrictions or limitations for woodland use or management.

The soils of Logan County are in subclases, *o*, *w*, *c*, and *x*.

WOODLAND GROUPS are subdivisions within the subclasses. The factors considered in placing a soil in a woodland group include: (1) potential productivity for several kinds of trees, (2) species to favor in managing existing woodland, (3) species preferred for planting, and (4) critical soil-related hazards and limitations to be considered in woodland management, namely erosion, use of equipment, plant competition, and seedling mortality.

Woodland groups are designated by an Arabic numeral added to the subclass and class symbols; for example, 2w1. Hence, the first Arabic numeral designates the class, or potential productivity; the small letter indicates the subclass, or kind of limitation; and the second Arabic numeral, assigned on a statewide basis, specifically identifies the woodland group within each subclass. Not all groups in the State are in this county.

Potential productivity within each group is expressed as site index, or the expected average height in feet that the dominant and codominant tree species will attain on a specified soil or group of soils at a specified age—50 years for most species.

Fast-growing species, such as yellow-poplar, pin oak, sweetgum, and cottonwood, have a site index of more than 95 on class 1 soils, 85 to 95 on class 2 soils, 75 to 85 on class 3 soils, 65 to 75 on class 4 soils, 55 to 65 on class 5 soils, and less than 55 on class 6 soils.

Trees that have a moderate growth rate, such as oak, Virginia pine, and shortleaf pine, have a site index of more than 85 on class 1 soils, 75 to 85 on class 2 soils, 65 to 75 on class 3 soils, 55 to 65 on class 4 soils, 45 to 55 on class 5 soils, and less than 45 on class 6 soils.

Slow-growing species, such as redcedar, have a site index of more than 65 on class 1 soils, 55 to 65 on class 2 soils, 45 to 55 on class 3 soils, 35 to 45 on class 4 soils, and less than 35 on class 5 soils.

Trees in this county and in adjacent areas were measured and the soils described at each site in the process of gathering data from which to determine the site indexes for wood crops. The studies were confined to well-stocked, naturally occurring, even-aged, essentially unmanaged stands that had not been adversely affected by fire, insects, diseases, or grazing. Tree heights and age were measured using acceptable forest measuring procedures.

The average height and age measurements for most species were converted to site index by using site index curves in published research (*3*, *4*, *5*, *9*, *12*). Unpublished field studies by the Tennessee Valley Authority of 271 plots were used to estimate the site indexes for eastern redcedar.

Predictions of average yearly growth per acre were recorded in board feet, according to the International ¼-inch rule, (*8*, *9*, *11*, *12*, *13*). Estimates were made for oak and yellow-poplar as much as 60 years old, and for other species as much as 50 years old.

Limitations of the soils for woodland—the hazard of erosion, equipment limitation, seedling mortality, and plant competition—are defined in the following paragraphs.

Hazard of erosion is the potential soil erosion that can occur following logging and exposure of the soil along roads, skid trails, fire lanes, and landing areas. It is assumed that the woodland is well managed and is protected from fire and grazing. Soil characteristics or properties considered in rating the hazard of erosion were slope, rate of infiltration, permeability of the subsoil, water-storage capacity, and resistance to detachment of soil particles by rainfall and runoff. A rating of *slight* indicates that no erosion-control measures are needed, *moderate* indicates that some attention needs to be given to the prevention of soil erosion, and *severe* indicates that intensive erosion-control measures are needed. Erosion can be kept to a minimum by taking care in locating, constructing, and maintaining roads, trails, fire lanes, and landings.

TABLE 3.—*Woodland*

[Gullied land is not rated because its properties are

Woodland suitability groups	Estimated potential productivity		
	Species	Site index	Average annual growth
			Board feet per acre
Group 1o1. Nearly level, Clifty, Cuba, and Nolin soils on flood plains. The soils are deep, well drained, and very high in potential productivity.	Upland oaks Yellow-poplar Virginia pine	85+ 95+ 85+	350+ 500+ 650+
Group 1o2. Nearly level to sloping Crider and Pembroke soils on uplands. These soils are deep, well drained, and very high in potential productivity.	Upland oaks Yellow-poplar Virginia pine	85+ 95+ 85+	350+ 500+ 650+
Group 1w1. Nearly level Lindside, Newark, and Steff soils on flood plains. These soils are deep, moderately well drained to somewhat poorly drained, and very high in potential productivity.	Lowland oaks Sweetgum Cottonwood	95+ 95+ 95+	450+ 500+ 570+
Group 1w2. Nearly level Bonnie, Dunning, Karnak, and Melvin soils on flood plains. These soils are deep, poorly drained, and very high in potential productivity.	Lowland oaks Sweetgum	95+ 95+	450+ 500+
Group 2o1. Dominantly gently sloping to strongly sloping Allegheny, Baxter, Elk, Hartsells, Linker, Pembroke, Pickwick, and Wellston soils. These soils are deep, well drained, and high in potential productivity.[1]	Upland oaks Yellow-poplar	75–85 85–95	240–350 380–500
Group 2c1. Gently sloping and sloping Cumberland soils. These soils are deep, well drained, and high in potential productivity.	Upland oaks Sweetgum	75–85 85–95	240–350 380–500
Group 2w1. Nearly level Johnsburg, Lawrence, and Robertsville soils. These soils are moderately deep over a fragipan, somewhat poorly drained or poorly drained, and high in potential productivity.	Upland oaks Sweetgum	75–85 85–95	240–350 380–500
Group 3o1. Gently sloping to strongly sloping Baxter, Frondorf, and Zanesville soils. These soils are deep, well drained, and moderate in potential productivity.	Upland oaks Shortleaf pine Virginia pine	65–75 65–75 65–75	160–240 540–670 450–540
Group 3c1. Gently sloping to strongly sloping Colbert, Cumberland, and Talbott soils on uplands. These soils have a clayey subsoil and are moderately deep to deep, well drained and moderately well drained, and moderate in potential productivity.	Upland oaks Redcedar	65–75 45–55	160–240 ----------
Group 3w1. Nearly level to sloping Nicholson, Sadler, and Epley soils on uplands. These soils are moderately deep over a fragipan, moderately well drained, and moderate in potential productivity.	Upland oaks Sweetgum	65–75 75–85	160–240 280–390
Group 3x1. Gently sloping to strongly sloping, rocky Fredonia, Talbott, and Colbert soils. These soils are moderately deep, well drained, and moderate in potential productivity.	Upland oaks Shortleaf pine Redcedar	65–75 65–75 45–55	160–240 540–670 ----------
Group 3x2. Strongly sloping to steep, very stony or rocky Colbert, Frondorf, and Talbott soils. These soils are moderately deep and moderate in potential productivity.	Upland oaks Shortleaf pine Redcedar	65–75 65–75 45–55	160–240 540–670 ----------
Group 4c1. Sloping to strongly sloping, severely eroded, clayey Colbert and Talbott soils. These soils are moderately deep, moderately well drained or well drained, and low in potential productivity.	Upland oaks Virginia pine Redcedar	55–65 55–65 35–45	90–160 370–450 ----------
Group 4x1. Very rocky, strongly sloping to steep, clayey Fredonia and Colbert soils and Rock outcrop. These soils are low in potential productivity.	Upland oaks Virginia pine Redcedar	55–65 55–65 35–45	90–160 370–450 ----------

[1] Severely eroded phases of the Pembroke and Pickwick soils in this group are moderate in potential productivity.

interpretations by woodland group

variable, and it requires onsite examination]

Management limitations					Suitable species—	
Erosion hazard	Equipment limitation	Seedling mortality	Plant competition		To favor in existing stands	For planting
			Conifers	Hardwoods		
Slight	Slight	Slight	Severe	Severe	Yellow-poplar, black walnut, white ash, cottonwood, white oak, loblolly pine, and red oak.	Yellow-poplar, black walnut, cottonwood, white pine, loblolly pine, shortleaf pine, black walnut, and white ash.
Slight	Slight	Slight	Severe	Severe	Yellow-poplar, black walnut, white oak, white ash, and red oak.	White pine, white ash, black locust, black walnut, loblolly pine, shortleaf pine, and yellow-poplar.
Slight	Moderate	Slight	Severe	Severe	White ash, yellow-poplar, red oak, sweetgum, cottonwood, and pin oak.	Loblolly pine, sweetgum, sycamore, and cottonwood.
Slight	Severe	Severe	Severe	Severe	Pin oak, red maple, sweetgum, sycamore, and cottonwood.	Loblolly pine, sycamore, pine oak and sweetgum.
Slight	Slight	Slight	Severe	Moderate	Red oak, white ash, white oak, yellow-poplar, black walnut, loblolly pine, and white pine.	White pine, yellow-poplar, black walnut, loblolly pine, shortleaf pine, black locust, and white ash.
Slight	Moderate	Slight	Severe	Severe	Yellow-poplar, white pine, Virginia pine, loblolly pine, red oak, white oak, and black walnut.	Yellow-poplar, white pine, loblolly pine, shortleaf pine, black walnut, white ash, and black locust.
Slight	Moderate	Slight	Severe	Severe	Sweetgum, pin oak, sycamore, white ash, yellow-poplar, and loblolly pine.	Sweetgum, sycamore, pin oak, white ash, and loblolly pine.
Slight	Slight	Slight	Moderate	Slight	Black oak, red oak, Virginia pine, white oak, and shortleaf pine.	Loblolly pine, shortleaf pine, Virginia pine, redcedar, and white pine.
Slight	Moderate	Slight	Moderate	Slight	Redcedar, red oak, post oak, loblolly pine, shortleaf pine, and Virginia pine.	Loblolly pine, redcedar, Virginia pine, and shortleaf pine.
Slight	Moderate	Slight	Moderate	Slight	White oak, Southern red oak, black oak, sweetgum, and hickory.	Loblolly pine, sweetgum, and white ash.
Moderate	Moderate to severe.	Slight to moderate.	Moderate	Slight	White oak, red oak, Virginia pine, redcedar, and hickory.	Virginia pine and redcedar.
Moderate to severe.	Moderate to severe.	Slight to moderate.	Moderate	Slight	White oak, red oak, Virginia pine, redcedar, and hickory.	Virginia pine and redcedar.
Moderate	Moderate	Severe	Slight	Slight	Redcedar, red oak, and white oak.	Redcedar.
Moderate to severe.	Severe	Severe	Slight	Slight	Redcedar, red oak, and white oak.	Redcedar.

Equipment limitations are influenced by topographic features and soil characteristics, such as slope, drainage, soil texture, and stoniness and rockiness, that restrict the use of conventional wheel or track-type equipment for harvesting and planting wood crops, constructing logging roads, and controlling fire and unwanted vegetation. Topography conditions or differences in soils can necessitate using different kinds of equipment and methods of operation or varying the season when equipment is used. Generally, the limitation is *slight* if the slope is 20 percent or less, soil wetness is not a problem, and farm machinery can be operated efficiently without construction and maintenance of permanent roads and trails. The rating is *moderate* if the slope is 20 to 30 percent, use of ordinary farm machinery is limited, track-type equipment is necessary for efficient harvesting, or soil wetness prevents the use of logging vehicles for 2 to 6 months. The rating is *severe* if the slope is more than 30 percent, track-type equipment is not adequate for harvesting and power vehicles and other special equipment are needed, or wetness prevents the use of vehicles for 6 months or more.

Seedling mortality is the mortality of naturally occurring or planted tree seedlings. It is influenced by such soil characteristics as drainage, effective rooting depth, surface texture, and aspect. Plant competition is not considered in these ratings. The rating is *slight* if expected mortality is 0 to 25 percent, *moderate* if it is 25 to 50 percent, and *severe* if it is more than 50 percent. If the rating is moderate or severe, replanting is likely to be needed to insure a fully stocked stand, and special preparation of the seedbed and special planting techniques are necessary in many places.

Plant competition is the invasion of unwanted trees, vines, shrubs, and other plants on a site where openings are made in the canopy. This competition hinders the establishment and normal development of desirable seedlings, whether they occur naturally or are planted. Among the soil characteristics that influence plant competition are drainage, productivity, and acidity. Plant competition is *slight* if unwanted plants do not prevent adequate natural regeneration, interfere with early growth, or restrict the normal development of planted stock. Competition is *moderate* if unwanted plants delay establishment and hinder the growth of either planted stock or naturally regenerated seedlings, or if they retard the development of a fully stocked stand. Competition is *severe* if unwanted plants prevent adequate restocking, either by natural regeneration or by planting, without intensive site preparation or special maintenance practices.

Use of the Soils for Wildlife

The welfare of a wildlife species depends largely on the amount and distribution of food, shelter, and water (*1*). If any of these elements is missing, inadequate, or inaccessible, the species is scarce or is not represented. The kinds of wildlife that live in a given area and the number of each kind are closely related to land use, to the resultant kinds and patterns of vegetation, and to the supply and distribution of water. These, in turn, are generally related to the kinds of soil.

Habitat for wildlife normally can be created or improved by planting suitable vegetation, properly managing the existing plant cover, fostering the natural establishment of desirable plants, or a combination of these measures.

The soils of Logan County are rated according to their suitability for eight elements of wildlife habitat and three classes of wildlife. These suitability ratings can be used as an aid in the following activities:

1. Planning the broad use of parks, refuges, nature-study areas, and other developments for wildlife.
2. Selecting the better soils for creating, improving, or maintaining specific kinds of wildlife habitat elements.
3. Determining the relative intensity of management needed for individual habitat elements.
4. Eliminating sites that would be difficult or not feasible to manage for specific kinds of wildlife.
5. Determining areas that are suitable for acquisition for use by wildlife.

Table 4 lists the soils in Logan County and rates their suitability for eight elements of wildlife habitat and for three classes, or groups, of wildlife. The ratings used are *good*, *fair*, *poor*, and *very poor*.

On soils rated *good*, habitat generally is easy to establish, improve, or maintain. There are few or no soil limitations in habitat management, and satisfactory results are well assured.

On soils rated *fair*, habitat generally can be established, improved, or maintained, but the soils have moderate limitations that affect these actions. A moderate intensity of management and fairly frequent attention may be required to assure satisfactory results.

On soils rated *poor*, habitat generally can be established, improved, or maintained, but soil limitations are rather severe. Habitat management can be difficult and expensive and may require intensive effort. Satisfactory results are unlikely.

On soils rated *very poor*, it is impractical to establish, improve, or maintain habitat because limitations are very severe. Unsatisfactory results are likely.

Not considered in the ratings are present land use, location of a soil in relation to other soils, and mobility of wildlife.

The elements of wildlife habitat are discussed in the following paragraphs.

Grain and seed crops.—These crops, include such seed-producing annuals as corn, sorghum, wheat, barley, oats, millet, buckwheat, cowpeas, and other plants commonly grown for grain or seed. The major soil properties that affect this habitat element are effective root depth, available water capacity, natural drainage, slope, surface stoniness, hazard of flooding, and texture of the surface layer and subsoil.

Domestic grasses and legumes.—This group consists of domestic perennial grasses and herbaceous legumes that are established by planting and that furnish wildlife cover and food. Among them are bluegrass, fescue, brome, timothy, orchardgrass, reed canarygrass, clover, and alfalfa. The major soil properties that affect this habitat element are effective root depth, available water capacity,

natural drainage, slope, surface stoniness, hazard of flooding, and texture of the surface layer and subsoil.

Wild herbaceous plants.—In this group are native or introduced perennial grasses and weeds that generally are established naturally. These plants include bluestem, quackgrass, panicgrass, goldenrod, wild carrot, nightshade, and dandelion. They provide food and cover mainly for upland forms of wildlife. The main soil properties that affect this habitat element are effective root depth, available water capacity, natural drainage, surface stoniness, hazard of flooding or ponding, and texture of the surface layer and subsoil.

Hardwoods.—These are nonconiferous trees, shrubs, and woody vines that produce nuts or other fruits, buds, catkins, twigs, or foliage that wildlife eat. They are generally established naturally, but in places are planted. Among the native trees are oak, cherry, maple, poplar, apple, hawthorn, dogwood, persimmon, sumac, sassafras, hazelnut, black walnut, hickory, sweetgum, bayberry, blueberry, huckleberry, blackhaw, viburnum, grape, and brier. The major soil properties that affect this habitat element are effective root depth, available water capacity, natural drainage, and surface stoniness or rockiness.

Several varieties of fruiting shrubs are raised commercially for planting. Autumn-olive, Amur honeysuckle, Tatarian honeysuckle, crabapple, multiflora rose, highbush cranberry, and silky cornel dogwood generally are available and can be planted on soils rated well suited. Hardwoods that are not available commercially can commonly be transplanted successfully.

Conifers.—This element consists of cone-bearing evergreen trees and shrubs that are used by wildlife mainly as cover, although they also provide browse and seeds or fruitlike cones. In this group are Norway spruce, Virginia pine, loblolly pine, shortleaf pine, pond pine, Scotch pine, redcedar, and Atlantic white-cedar. Generally, the plants are established naturally in areas where the cover of weeds and sod is thin, but they can also be planted. The major soil properties that affect this habitat element are effective root depth, available water capacity, natural drainage, surface stoniness or rockiness, and texture of the surface layer and subsoil. Well-suited soils are those on which plants grow slowly and delay closing the canopy. Branches must be maintained close to the ground if food and cover are to be readily available to rabbits, pheasants, and other small animals. If the trees quickly form a dense canopy that shuts out light, the lower branches die.

On soils poorly suited to coniferous wildlife habitat, widely spaced conifers can quickly but only temporarily produce the desired growth. Conifers are difficult to maintain, because the soils that are poorly suited to conifers are well suited to hardwoods and unless the stand is carefully managed hardwoods invade and commonly overtop the conifers.

Wetland plants.—This group consists of wild, herbaceous, annual and perennial plants that grow on moist to wet sites, exclusive of submerged or floating aquatics. These plants produce food and cover that is extensively used, mainly by wetland wildlife. They are smartweed, wild millet, bulrush, sedges, barnyardgrass, pondweed, duckweed, duckmillet, arrow-arum, pickerelweed, water willow, wetland grasses, wildrice, and cattail. The major soil properties that affect this habitat element are natural drainage, surface stoniness, frequency of flooding or ponding, slope, and texture of the surface layer and subsoil.

Shallow-water areas.—These are impoundments or excavations that provide areas of shallow water, generally not more than 5 feet deep, near food and cover for wetland wildlife. Examples of such developments are shallow dugouts, level ditches, blasted potholes, and devices that keep the water in marshes 6 to 24 inches deep. The major soil properties that affect this habitat element are depth to bedrock, natural drainage, slope, hazard of flooding, and surface stoniness.

Table 4 rates the soils of Logan County according to their suitability for three classes of wildlife—openland, woodland, and wetland. These classes are described in the paragraphs that follow.

Openland wildlife.—Examples of openland wildlife are quail, pheasant, meadowlark, field sparrow, dove, cottontail rabbit, red fox, and woodchuck. These birds and mammals normally make their home in areas of crops, pasture, meadow, and lawns and in areas overgrown with grasses, herbs, and shrubs.

Woodland wildlife.—Among the birds and mammals that prefer woodland are ruffed grouse, woodcock, thrush, vireo, scarlet tanager, gray squirrel, red squirrel, gray fox, white-tailed deer, raccoon, and wild turkey. These animals obtain food and cover in stands of hardwoods, coniferous trees, shrubs, or a mixture of these plants.

Wetland wildlife.—Duck, geese, rail, heron, shore birds, and muskrat are familiar examples of birds and mammals that normally make their home in ponds, marshes, swamps, and other wet areas.

Each rating under "Classes of wildlife" in table 4 is based on the ratings listed for the habitat elements in the first part of the table. For openland wildlife the rating is based on the ratings shown for grain and seed crops, domestic grasses and legumes, wild herbaceous plants, hardwood trees, and coniferous plants. The rating for woodland wildlife is based on the ratings listed for domestic grasses and legumes, wild herbaceous plants, hardwood trees, and coniferous plants. For wetland wildlife the rating is based on the ratings shown for wetland plants and shallow-water areas.

Engineering Uses of the Soils [4]

This section provides useful information about soils used as structural material or as foundation upon which structures are built. Among those who can benefit from this section are planning commissions, town and city managers, land developers, engineers, contractors, and farmers.

Among the soil properties most important in engineering are permeability, shear strength, compaction characteristics, drainage, shrink-swell potential, grain-size distribution, plasticity, and reaction. Also important are depth to bedrock and slope. These properties, in various degrees and combinations, affect the construction and maintenance of roads, airports, pipelines, foundations for

[4] RALPH E. JOHNSON, engineer, Soil Conservation Service, helped prepare this section.

TABLE 4.—*Rating of soils for elements of wildlife habitat and kinds of wildlife*

Soil series and mapping unit symbols	Elements of wildlife habitat							
	Grain and seed crops	Domestic grasses and legumes	Wild herbaceous plants	Hardwood plants	Coniferous trees	Wetland plants	Shallow-water areas	Openland
Allegheny:								
AlB	Good	Good	Good	Good	Good	Poor	Very poor	Good
AlC	Fair	Good	Good	Good	Good	Poor	Very poor	Good
AsD	Poor	Fair	Very poor	Fair	Good	Very poor	Very poor	Poor
Baxter: BaC, BaD, BbC3.	Fair	Good	Good	Good	Good	Poor	Very poor	Good
Bonnie: Bo	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair
Clifty: Cf	Good	Good	Good	Good	Good	Poor	Very poor	Good
Colbert:								
CoC	Fair	Good	Fair	Good	Good	Poor	Very poor	Fair
CpC3	Poor	Fair	Poor	Fair	Fair	Poor	Very poor	Poor
Crider:								
CrA, CrB	Good	Good	Good	Good	Good	Poor	Very poor	Good
CrC	Fair	Good	Good	Good	Good	Poor	Very poor	Good
Cuba: Cu	Good	Fair	Fair	Good	Good	Poor	Good	Fair
Cumberland:								
CvB	Good	Good	Good	Good	Good	Poor	Poor	Good
CvC, CwC3	Fair	Good	Good	Good	Good	Poor	Poor	Fair
Dunning: Du	Very poor	Poor	Poor	Poor	Poor	Good	Good	Poor
Elk:								
ElA	Good	Good	Good	Good	Good	Poor	Fair	Good
ElB	Good	Good	Good	Good	Good	Poor	Very poor	Good
ElC	Fair	Good	Good	Good	Good	Poor	Very poor	Good
Epley:								
EpB	Good	Good	Good	Good	Good	Good	Poor	Good
EpC	Fair	Good	Good	Good	Good	Good	Poor	Good
Fredonia: FeC	Poor	Poor	Good	Good	Good	Poor	Very poor	Fair
Frondorf:								
FrC	Fair	Good	Fair	Fair	Fair	Poor	Very poor	Fair
FrD	Poor	Good	Fair	Fair	Fair	Poor	Very poor	Fair
FsF	Very poor	Poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor
Gullied land: Gu	Very poor	Very poor	Poor	Poor	Poor	Very poor	Very poor	Very poor
Hartsells: HaC	Fair	Good	Good	Good	Good	Poor	Very poor	Good
Johnsburg: Jo	Fair	Good	Good	Good	Good	Fair	Fair	Good
Karnak: Ka	Poor	Fair	Fair	Fair	Fair	Poor	Fair	Fair
Lawrence: La	Fair	Good	Good	Good	Good	Fair	Fair	Good

Lindside: Ld	Good	Good	Good	Good	Good	Poor	Good	Good
Linker:								
LnB	Good	Good	Good	Good	Good	Poor	Very poor	Good
LnC	Fair	Good	Good	Good	Good	Poor	Very poor	Good
Melvin: Me	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair
Newark: Ne	Fair	Good	Good	Good	Good	Good	Good	Good
Nicholson:								
NhA	Fair	Good	Good	Good	Good	Poor	Poor	Good
NhB, NhC	Fair	Good	Good	Good	Good	Poor	Very poor	Good
Nolin: No	Good	Good	Good	Good	Good	Good	Good	Good
Pembroke:								
PeA, PeB	Good	Good	Good	Good	Good	Poor	Very poor	Good
PeC, PfC3	Fair	Good	Good	Good	Good	Poor	Very poor	Good
Pickwick:								
PkB	Good	Good	Good	Good	Good	Poor	Very poor	Good
PkC, PlC3	Fair	Good	Good	Good	Good	Poor	Very poor	Good
Robertsville: Ro	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair
Rock outcrop: Rx. For Fredonia part, see Fredonia series; for Colbert part, see CoC under Colbert series.	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor
Sadler:								
SaA	Good	Good	Good	Good	Good	Poor	Poor	Good
SaB	Good	Good	Good	Good	Good	Poor	Very poor	Good
Steff: St	Good	Good	Good	Good	Good	Poor	Poor	Good
Talbott:								
TaB	Fair	Good	Good	Good	Good	Poor	Very poor	Good
TaC, TaD	Fair	Good	Good	Good	Good	Very poor	Very poor	Good
TbD3	Fair	Fair	Fair	Good	Good	Very poor	Very poor	Fair
TcD	Poor	Fair	Good	Fair	Fair	Very poor	Very poor	Fair
TcF. The ratings for TcD and TcF are for both Talbott and Colbert soils.	Very poor	Poor	Good	Fair	Fair	Very poor	Very poor	Poor
Wellston:								
WeB	Good	Good	Good	Good	Good	Poor	Very poor	Good
WeC	Fair	Good	Good	Good	Good	Poor	Very poor	Good
Zanesville: ZaB, ZaC	Fair	Good	Good	Good	Good	Poor	Very poor	Good

small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures to control water and conserve soil.
5. Correlate performance of structures already built with properties of the kinds of soil on which they are built, for the purpose of predicting performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables 5, 6, and 7, which show, respectively, several estimated soil properties significant to engineering; interpretations for various engineering uses; and results of engineering laboratory tests on soil samples.

The information in these tables can be used along with the soil map and other parts of this publication to make interpretations in addition to those given in tables 5 and 6, and it also can be used to make other useful maps.

This information, however, does not eliminate the need for further investigations at sites selected for engineering works, especially works that involve heavy loads or require excavations to depths greater than those shown in the tables, generally depths of more than 6 feet. Also, inspection of sites, especially the small ones, is needed because many delineated areas of a given soil mapping unit contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for soil engineeering.

Some of the terms used in this soil survey have special meaning to soil scientists. The Glossary defines many of these terms as they are commonly used in soil science.

Engineering soil classification systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified system (*10*, *17*) used by the Soil Conservation Service, Department of Defense, and other agencies and the AASHO system (*2*, *10*) adopted by the American Association of State Highway Officials.

In the Unified system, soils are classified according to particle-size distribution, plasticity, liquid limit, and organic-matter content. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes; for example, ML–CL.

The AASHO system is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system, a soil is placed in one of seven basic groups that range from A–1 to A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A–1 are gravelly soils of high bearing strength, the best soils for subgrade (foundation). At the other extreme, in group A–7, are clay soils that have low strength when wet and are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A–1, A–2, and A–7 groups are divided as follows: A–1–a, A–1–b; A–2–4, A–2–5, A–2–6, A–2–7; and A–7–5 and A–7–6. As additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest. The AASHO classification for tested soils, with group index numbers in parentheses, is shown in table 7; the estimated classification, without group index numbers, is given in table 5 for all soils mapped in Logan County.

USDA texture is determined by the relative proportions of sand, silt, and clay in soil material that is less than 2.0 millimeters in diameter. Sand, silt, clay, and some of the other terms used in the USDA textural classification are defined in the Glossary.

Estimated soil properties significant to engineering

Several estimated soil properties significant to engineering are shown in table 5. These estimates are made for representative soil profiles, by layers sufficiently different to have different significance for soil engineering. The estimates are based on field observations made in the course of mapping, on test data for these and similar soils, and on experience with the same kinds of soil in other counties. Following are explanations of some of the columns in table 5.

Depth to bedrock is distance from the surface of the soil to the upper surface of the rock layer.

Depth to seasonal high water table is distance from the surface of the soil to the highest level that ground water reaches in the soil during most years.

Soil texture is described in table 5 in the standard terms used by the Department of Agriculture. These terms take into account the relative percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. Loam, for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added; for example, gravelly loamy sand. The Unified and AASHO classification are explained under the heading "Engineering soil classification systems."

Permeability is that quality of a soil that enables it to transmit water or air. It is estimated on the basis of soil characteristics observed in the field, particularly structure and texture. The estimates in table 5 do not take into account lateral seepage or such transient soil features as plowpans and surface crusts.

Available moisture capacity is the ability of soils to hold water for use by most plants. It is commonly defined as the difference between the amount of water in

the soil at field capacity and the amount at the wilting point of most crop plants.

Reaction is the degree of acidity or alkalinity of a soil, expressed as a pH value. The pH value and other terms used to describe soil reaction are explained in the Glossary.

Shrink-swell potential is the relative change in volume to be expected of soil material with changes in moisture content, that is, the extent to which the soil shrinks as it dries out or swells when it gets wet. The extent of shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soils cause much damage to building foundations, roads, and other structures. A *high* shrink-swell potential indicates a hazard to maintenance of structures built in, on, or with material that has this rating.

Interpretations of engineering properties of the soils

Table 6 rates the soils according to their suitability as a source of topsoil and road fill. Sources of sand and gravel were not rated, because there are no deposits of significance in the county. Soil suitability is indicated by the terms *good*, *fair*, and *poor*.

Also shown in table 6 are features that affect the suitability of the soils for several uses related to engineering. Listed are features that are detrimental or undesirable and that should not be overlooked in planning, installation, and maintenance. The interpretations in table 6 are based on soil properties shown in table 5, on available test data, and on the experience of engineers and soil scientists.

Topsoil is used for topdressing an area where vegetation is to be established and maintained. Suitability is affected mainly by ease of working and spreading the soil material, as for preparing a seedbed; by natural fertility of the material, or the response of plants when fertilizer is applied; and by absence of substances toxic to plants. Texture of the soil material and its content of stone fragments are characteristics that affect suitability, but also considered in the ratings is damage that results at the area from which topsoil is taken.

Road fill is soil material used in embankments for roads. The suitability ratings reflect (1) the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage and (2) the relative ease of excavating the material at borrow areas.

Reservoir areas hold water behind a dam or embankment. Soils suitable for pond reservoir areas have a low seepage rate, which is related to their permeability and depth to fractured or permeable bedrock or other permeable material.

Embankments require soil material that is resistant to seepage and piping and of favorable stability, shrink-swell potential, shear strength, and compactibility. Stones or organic material in a soil are among factors that are unfavorable for this use.

Drainage for crops and pasture is affected by such soil properties as permeability, texture, and structure; depth to claypan, rock, or other layers that influence rate of water movement; depth to the water table; slope; stability in ditchbanks; susceptibility to stream overflow; salinity or alkalinity; and availability of outlets for drainage.

Irrigation of a soil is affected by such features as slope; susceptibility to stream overflow, water erosion, or soil blowing; soil texture; content of stones; accumulation of salts and alkali; depth of root zone; rate of water intake at the surface; permeability of soil layers below the surface layer and of fragipans or other layers that restrict movement of water; amount of water held available to plants; and need for drainage, or depth to water table or bedrock.

Terraces and diversions are embankments, or ridges, constructed across the slope to intercept runoff and seepage so that it soaks into the soil or flows slowly to a prepared outlet. Features that affect suitability of a soil for these uses are uniformity and steepness of slope; depth to bedrock or other unfavorable material; presence of stones; permeability; and resistance to water erosion, soil slipping, and soil plowing. A soil that is suitable for these structures provides outlets for runoff and is not difficult to vegetate.

Grassed waterways are affected by such soil properties as texture, depth, and erodibility of the soil material; presence of stones or rock outcrops; and steepness of slopes. Other factors that affect waterways are seepage, natural soil drainage, available water capacity, susceptibility to siltation, and the ease of establishing and maintaining vegetation.

Engineering test data

Table 7 contains engineering test data for some of the major soil series in Logan County. These tests were made to help evaluate the soils for engineering purposes. The engineering classifications shown are based on data obtained by mechanical analyses and by tests made to determine liquid limits and plastic limits. The mechanical analyses were made by combined sieve and hydrometer methods.

Compaction, or moisture-density, data are important in earthwork. If a soil material is compacted at successively higher moisture contents, assuming that the compactive effort remains constant, the density of the compacted material increases until the *optimum moisture content* is reached. After that, density decreases as the moisture content increases. The highest dry density obtained in the compactive test is called the *maximum dry density*. As a rule, maximum strength of earthwork is obtained if the soil is compacted to the maximum dry density.

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from a semisolid to a plastic state. If the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material changes from the semisolid to plastic state; and the liquid limit, from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic.

TABLE 5.—*Estimated soil*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil that may appear in the first column. The symbol > means

Soil series and map symbols	Depth to— Bedrock	Depth to— Seasonal high water table	Depth from surface of representative profile	Classification [1] USDA texture	Unified	AASHO
	Feet	*Feet*	*Inches*			
Allegheny: AlB, AlC, AsD	>3½	(3)	0–11	Loam	ML	A–4
			11–40	Clay loam	ML or CL	A–6
			40–50	Sandy clay	CL or SC	A–7
Baxter: BaC, BaD, BbC3	>6	(3)	0–9	Cherty silt loam	ML or CL	A–4 or A–6
			9–16	Cherty silty clay loam	CL	A–6 or A–7
			16–32	Cherty silty clay	CH or MH	A–7
			32–100	Cherty clay	CH	A–7
Bonnie:[4] Bo	>6	0–½	0–8	Silt loam	ML	A–4
			8–33	Silt loam	ML or CL	A–4 or A–6
			33–67	Light silty clay loam	CL	A–6
Clifty:[4] Cf	>5	>4	0–10	Gravelly silt loam	ML	A–4
			10–24	Gravelly fine sandy loam	GM, SM, or ML	A–2 or A–4
			24–45	Gravelly silt loam	GM or SM	A–2 or A–4
Colbert: CoC, CpC3	2½–7	(3)	0–7	Silt loam	ML or CL	A–4 or A–6
			7–11	Silty clay loam	CL, MH, or CH	A–7
			11–51	Clay	CH or MH	A–7
Crider: CrA, CrB, CrC	>5	(3)	0–12	Silt loam	ML	A–4
			12–44	Silt loam	ML or CL	A–4 or A–6
			44–76	Silty clay loam	CL or CH	A–7
Cuba:[4] Cu	>4	4	0–44	Silt loam	ML or CL	A–4 or A–6
			44–70	Silt loam, loam, and fine sandy loam.	ML	A–4
Cumberland: CvB, CvC, CwC3	>5	(3)	0–6	Silt loam	ML or CL	A–4 or A–6
			6–11	Silty clay loam	CL, MH, or CH	A–7
			11–60	Clay	MH or CH	A–7
Dunning:[4] Du	>3½	0–½	0–12	Silty clay loam	CL, CH, or MH	A–6 or A–7
			12–30	Silty clay	CL or CH	A–7
			30–52	Clay	CL or CH	A–7
Elk: ElA, ElB, ElC	>5	(3)	0–13	Silt loam	ML or CL	A–4
			13–27	Light silty clay loam	CL	A–4 or A–6
			27–48	Silt loam	ML or CL	A–4
			48–60	Gravelly loam	GM or ML	A–4
Epley: EpB, EpC	>4	1½–2½	0–19	Silt loam	ML or CL	A–4
			19–24	Silty clay loam	CL	A–6 or A–7
			24–37	Silty clay	CL or CH	A–7
			37–64	Clay	CL or CH	A–7
Fredonia: FeC	1½–3½	(3)	0–6	Silty clay loam	CL	A–6
			6–20	Silty clay	CL or CH	A–7
			20–32	Clay	CL or CH	A–7
			>32	Limestone.		
Frondorf: FrC, FrD, FsF	1½–3½	(3)	0–14	Silt loam	ML	A–4
			14–25	Light silty clay loam	ML or CL	A–6
			25–34	Channery loam	GM or SM	A–1, A–2, or A–4
Gullied land: Gu. No estimates; most properties variable.	>2	(3)				

See footnotes at end of table.

properties significant to engineering

have different properties and limitations. It is therefore necessary to follow carefully the instructions for referring to other series that more than; the symbol < means less than]

Percentage of material less than 3 inches in diameter passing sieve—				Permeability	Available moisture capacity	Reaction [2]	Shrink-swell potential
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)				
				Inches per hour	*Inches per inch of soil*	*pH*	
95–100	95–100	90–100	70–80	0. 6–2. 0	0. 13–0. 17	4. 5–5. 5	Low.
95–100	95–100	90–100	70–80	0. 6–2. 0	0. 13–0. 17	4. 5–5. 5	Low.
95–100	95–100	85–95	45–60	0. 6–2. 0	0. 11–0. 15	4. 5–5. 5	Low.
70–95	65–90	60–90	55–85	0. 6–2. 0	0. 16–0. 21	4. 5–5. 5	Low.
65–85	65–80	60–80	55–75	0. 6–2. 0	0. 16–0. 21	4. 5–5. 5	Low.
65–85	65–85	60–80	55–75	0. 6–2. 0	0. 08–0. 12	4. 5–5. 5	Moderate.
65–95	60–90	60–85	55–80	0. 6–2. 0	0. 07–0. 12	4. 5–5. 5	Moderate.
95–100	95–100	85–100	70–90	0. 6–2. 0	0. 18–0. 23	4. 5–5. 5	Low.
95–100	95–100	90–100	75–95	0. 2–0. 6	0. 18–0. 23	4. 5–5. 5	Low.
95–100	95–100	90–100	85–95	0. 6–0. 2	0. 15–0. 19	4. 5–5. 5	Low.
65–90	60–85	60–80	50–75	2. 0–6. 0	0. 13–0. 18	4. 5–5. 5	Low.
65–90	60–85	55–75	30–55	2. 0–6. 0	0. 10–0. 14	4. 5–5. 5	Low.
50–75	45–70	40–65	30–55	2. 0–6. 0	0. 10–0. 15	4. 5–5. 5	Low.
95–100	95–100	90–100	80–95	0. 6–2. 0	0. 18–0. 23	5. 1–6. 5	Low.
95–100	95–100	95–100	85–100	0. 2–0. 6	0. 15–0. 19	5. 1–6. 5	Moderate.
90–100	75–100	70–100	70–100	<0. 06	0. 10–0. 15	5. 1–6. 5	High.
95–100	95–100	90–100	80–95	0. 6–2. 0	0. 18–0. 23	4. 5–6. 0	Low.
95–100	90–100	85–100	80–95	0. 6–2. 0	0. 18–0. 22	4. 5–6. 0	Low.
95–100	95–100	95–100	75–95	0. 6–2. 0	0. 14–0. 18	4. 5–6. 0	Low.
95–100	95–100	95–100	85–95	0. 6–2. 0	0. 18–0. 23	4. 5–5. 5	Low.
95–100	95–100	75–95	50–85	0. 6–2. 0	0. 15–0. 20	4. 5–5. 5	Low.
95–100	95–100	90–100	80–95	0. 6–2. 0	0. 18–0. 23	4. 5–5. 5	Low.
95–100	95–100	95–100	85–95	0. 6–2. 0	0. 15–0. 19	4. 5–5. 5	Low.
75–100	75–100	70–100	65–95	0. 6–2. 0	0. 10–0. 15	4. 5–5. 5	Moderate.
95–100	95–100	95–100	85–95	0. 2–0. 6	0. 15–0. 19	6. 1–7. 8	Moderate.
95–100	95–100	95–100	90–95	0. 06–0. 2	0. 12–0. 16	6. 1–7. 8	Moderate.
95–100	95–100	90–100	75–95	0. 06–0. 2	0. 10–0. 15	6. 1–7. 8	High.
95–100	90–100	90–100	75–95	0. 6–2. 0	0. 18–0. 23	4. 5–6. 0	Low.
95–100	95–100	90–100	85–95	0. 6–2. 0	0. 16–0. 20	4. 5–6. 0	Low.
95–100	95–100	90–100	75–95	0. 6–2. 0	0. 18–0. 23	4. 5–6. 0	Low.
60–85	55–80	45–70	35–60	2. 0–6. 0	0. 09–0. 13	4. 5–6. 0	Low.
95–100	95–100	90–100	70–90	0. 6–2. 0	0. 18–0. 23	5. 1–6. 0	Low.
95–100	95–100	95–100	90–100	0. 6–2. 0	0. 15–0. 19	5. 1–6. 0	Low.
95–100	95–100	90–100	80–95	0. 2–0. 6	0. 12–0. 15	5. 1–6. 0	Moderate.
85–100	85–100	85–100	75–95	0. 06–0. 2	0. 10–0. 14	5. 6–7. 3	Moderate.
95–100	95–100	90–100	85–95	0. 6–2. 0	0. 15–0. 19	5. 1–6. 0	Low.
95–100	95–100	90–100	80–95	0. 2–0. 6	0. 12–0. 16	5. 1–6. 0	Moderate.
80–100	80–100	80–100	75–95	0. 2–0. 6	0. 10–0. 15	5. 6–7. 3	Moderate.
95–100	95–100	90–100	70–90	0. 6–2. 0	0. 18–0. 23	4. 5–5. 5	Low.
65–95	60–95	55–95	50–90	0. 6–2. 0	0. 15–0. 19	4. 5–5. 5	Low.
40–75	35–65	30–60	20–45	2. 0–6. 0	0. 06–0. 11	4. 5–5. 5	Low.

TABLE 5.—*Estimated soil properties*

Soil series and map symbols	Depth to— Bedrock	Depth to— Seasonal high water table	Depth from surface of representative profile	Classification [1] USDA texture	Classification [1] Unified	Classification [1] AASHO
	Feet	*Feet*	*Inches*			
Hartsells: HaC	1½–3½	([3])	0–6	Loam	ML	A-4
			6–15	Light silty clay loam	CL	A-6
			15–38	Fine sandy loam	SM or ML	A-4
			38	Sandstone.		
Johnsburg: Jo	4–6	[5] ½–1½	0–20	Silt loam	ML	A-4
			20–41	Silt loam (fragipan)	ML or CL	A-4 or A-6
			41–56	Silty clay loam (fragipan)	CL	A-6 or A-7
Karnak:[4] Ka	>6	0–½	0–54	Silty clay	CH or CL	A-7
Lawrence: La	>5	[5] ½–1½	0–8	Silt loam	ML	A-4
			8–22	Silty clay loam	CL	A-6 or A-7
			22–52	Silty clay loam (fragipan)	CL	A-6 or A-7
Lindside:[4] Ld	>6	1½–3	0–68	Silt loam	ML or CL	A-4 or A-6
Linker: LnB, LnC	2–4	([3])	0–8	Loam	ML	A-4
			8–28	Sandy clay loam	SC or CL	A-4 or A-6
			28–48	Clay loam	ML or CL	A-6
			48	Sandstone conglomerate.		
Melvin:[4] Me	>4	0–½	0–42	Silt loam	ML or CL	A-4
			42–60	Light silty clay loam	CL or ML	A-4 or A-6
Newark:[4] Ne	>4	½–1½	0–19	Silty loam	ML	A-4
			19–29	Heavy silt loam	ML or CL	A-4 or A-6
			29–58	Silty clay loam	CL	A-6
Nicholson: NhA, NhB, NhC	>5	[5] 1½–2½	0–15	Silt loam	ML or CL	A-4
			15–25	Silty clay loam	CL	A-6
			25–42	Heavy silt loam or silty clay loam (fragipan).	ML or CL	A-4 or A-6
Nolin:[4] No	>4	4	0–60	Silt loam	ML or CL	A-4 or A-6
Pembroke: PeA, PeB, PeC, PfC3	>5	([3])	0–9	Silt loam	ML or CL	A-4
			9–41	Silty clay loam	CL	A-6 or A-7
			41–84	Silty clay	CL, CH, or MH	A-7
Pickwick: PkB, PkC, PlC3	>6	([3])	0–6	Silt loam	ML	A-4
			6–33	Silty clay loam	CL or CH	A-6 or A-7
			33–58	Heavy clay loam	ML, CL, or CH	A-6 or A-7
			58–98	Clay	ML, CL, or CH	A-7
Robertsville: Ro	>6	[5] 0–½	0–22	Silt loam	ML	A-4
			22–32	Heavy silt loam	ML or CL	A-4 or A-6
			32–50	Heavy silt loam (fragipan)	ML or CL	A-4 or A-6
*Rock outcrop: Rx. No estimates for Rock outcrop. For Fredonia part, see Fredonia series; for Colbert part, see Colbert series.						

See footnotes at end of table.

significant to engineering—Continued

Percentage of material less than 3 inches in diameter passing sieve—				Permeability	Available moisture capacity	Reaction [2]	Shrink-swell potential
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)				
				Inches per hour	*Inches per inch of soil*	*pH*	
90–100	95–100	90–100	70–80	2. 0–6. 0	0. 13–0. 17	4. 5–5. 0	Low.
100	100	95–100	85–95	2. 0–6. 0	0. 15–0. 19	4. 5–5. 0	Low.
70–95	65–95	55–80	35–55	2. 0–6. 0	0. 11–0. 15	4. 5–5. 0	Low.
95–100	95–100	90–100	70–95	0. 6–2. 0	0. 18–0. 23	4. 5–5. 5	Low.
95–100	95–100	90–100	70–90	<0. 06	0. 09–0. 12	4. 5–5. 5	Low.
95–100	95–100	95–100	85–95	<0. 06	0. 09–0. 12	4. 5–5. 5	Low.
95–100	95–100	95–100	85–95	0. 06–0. 2	0. 13–0. 17	5. 6–6. 5	High.
95–100	95–100	90–100	70–90	0. 6–2. 0	0. 18–0. 23	4. 5–5. 5	Low.
95–100	95–100	95–100	90–100	0. 6–2. 0	0. 15–0. 19	4. 5–5. 5	Low.
95–100	95–100	95–100	85–95	0. 06–0. 2	0. 09–0. 12	4. 5–5. 5	Low.
95–100	95–100	90–100	85–95	0. 6–2. 0	0. 18–0. 23	5. 6–7. 3	Low.
95–100	95–100	85–95	60–75	2. 0–6. 0	0. 13–0. 17	4. 5–5. 5	Low.
95–100	95–100	75–85	35–55	2. 0–6. 0	0. 11–0. 15	4. 5–5. 5	Low.
90–95	85–95	80–95	60–80	2. 0–6. 0	0. 11–0. 15	4. 5–5. 5	Low.
95–100	95–100	90–100	80–95	0. 6–2. 0	0. 18–0. 23	5. 6–7. 3	Low.
95–100	95–100	90–100	85–95	0. 6–2. 0	0. 15–0. 19	5. 6–7. 3	Low.
95–100	95–100	90–100	90–95	0. 6–2. 0	0. 18–0. 23	5. 6–7. 3	Low.
95–100	95–100	90–100	85–95	0. 6–2. 0	0. 17–0. 21	5. 6–7. 3	Low.
95–100	95–100	90–100	85–95	0. 6–2. 0	0. 15–0. 19	5. 6–7. 3	Low.
95–100	95–100	90–100	80–90	0. 6–2. 0	0. 18–0. 23	4. 5–6. 0	Low.
95–100	95–100	95–100	85–95	0. 6–2. 0	0. 15–0. 19	4. 5–6. 0	Low.
95–100	95–100	90–100	70–90	0. 6–2. 0	0. 09–0. 12	4. 5–6. 0	Low.
95–100	95–100	90–100	75–95	0. 6–2. 0	0. 18–0. 23	5. 6–7. 3	Low.
95–100	95–100	90–100	80–95	0. 6–2. 0	0. 18–0. 23	5. 1–6. 5	Low.
95–100	95–100	95–100	90–100	0. 6–2. 0	0. 15–0. 19	5. 1–6. 5	Low.
95–100	90–100	85–100	80–95	0. 6–2. 0	0. 12–0. 16	5. 1–6. 5	Moderate.
95–100	95–100	95–100	80–90	0. 6–2. 0	0. 18–0. 23	4. 5–5. 5	Low.
95–100	95–100	95–100	80–95	0. 6–2. 0	0. 15–0. 19	4. 5–5. 5	Low.
90–100	85–100	80–95	65–90	0. 6–2. 0	0. 13–0. 17	4. 5–5. 5	Low.
95–100	90–100	85–100	70–95	0. 6–2. 0	0. 09–0. 13	4. 5–5. 5	Low.
95–100	95–100	90–100	80–95	0. 6–2. 0	0. 18–0. 23	4. 5–5. 5	Low.
95–100	95–100	90–100	85–95	0. 2–0. 6	0. 17–0. 21	4. 5–5. 5	Low.
95–100	95–100	90–100	85–95	<0. 06	0. 09–0. 12	4. 5–5. 5	Low.

TABLE 5.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface of representative profile	Classification [1]		
	Bedrock	Seasonal high water table		USDA texture	Unified	AASHO
	Feet	*Feet*	*Inches*			
Sadler: SaA, SaB	>4	[5] 1½–2	0–7	Silt loam	ML	A–4
			7–23	Light silty clay loam	CL or ML	A–4 or A–6
			23–48	Light silty clay loam (fragipan).	CL	A–4 or A–6
			48–78	Silty clay loam	CL	A–6
Steff: [4] St	4–10	1½–2	0–19	Silt loam	ML	A–4
			19–38	Silt loam	ML or CL	A–4 or A–6
*Talbott: TaB, TaC, TaD, TbD3, TcD, TcF. For Colbert part of TcD and TcF, see Colbert series.	2–5	(3)	0–6	Silt loam	ML or CL	A–4 or A–6
			6–11	Silty clay	CL or CH	A–7
			11–40	Clay	CH or MH	A–7
			40	Limestone.		
Wellston: WeB, WeC	3½–6	(3)	0–12	Silt loam	ML	A–4
			12–41	Silty clay loam	CL, CH, or MH	A–6 or A–7
			41	Sandstone.		
Zanesville: ZaB, ZaC	3½–7½	[5] 2–2½	0–28	Silt loam	ML or CL	A–4
			28–37	Light silty clay loam (fragipan).	CL	A–6
			37–72	Silty clay	CL, MH, or CH	A–7

[1] All fragments larger than 3 inches in diameter are excluded from estimates. Soils that have fragments larger than 3 inches in diameter are minor in this county.

[2] The reaction shown is for those areas that have not been limed. The surface layer has a higher reaction where lime has been added

significant to engineering—Continued

Percentage of material less than 3 inches in diameter passing sieve—				Permeability	Available moisture capacity	Reaction [2]	Shrink-swell potential
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)				
				Inches per hour	*Inches per inch of soil*	*pH*	
100	95–100	90–100	80–95	0. 6–2. 0	0. 18–0. 23	4. 5–5. 5	Low.
95–100	95–100	95–100	85–95	0. 6–2. 0	0. 15–0. 19	4. 5–5. 5	Low.
95–100	95–100	90–100	80–95	0. 06–0. 2	0. 09–0. 12	4. 5–5. 5	Low.
95–100	95–100	90–100	80–95	0. 2–0. 6	0. 09–0. 12	4. 5–5. 5	Low.
95–100	95–100	90–100	70–90	0. 6–2. 0	0. 18–0. 23	4. 5–5. 5	Low.
95–100	95–100	90–100	70–90	0. 6–2. 0	0. 18–0. 23	4. 5–5. 5	Low.
95–100	95–100	90–100	80–95	0. 6–2. 0	0. 18–0. 23	5. 1–6. 0	Low.
95–100	95–100	95–100	85–95	0. 6–2. 0	0. 12–0. 16	5. 1–6. 0	Moderate.
95–100	90–100	85–100	70–95	0. 2–0. 6	0. 10–0. 14	5. 1–6. 0	Moderate.
95–100	95–100	90–100	75–95	0. 6–2. 0	0. 18–0. 23	4. 5–5. 5	Low.
95–100	85–100	80–100	60–90	0. 6–2. 0	0. 15–0. 19	4. 5–5. 5	Low.
95–100	95–100	90–100	80–95	0. 6–2. 0	0. 18–0. 23	4. 5–5. 5	Low.
95–100	95–100	90–100	80–95	0. 06–0. 2	0. 09–0. 14	4. 5–5. 5	Low.
95–100	95–100	95–100	90–95	0. 2–0. 6	0. 09–0. 14	4. 5–5. 5	Moderate.

[3] The depth to a water table has not been determined because the water table is normally below the surface of the bedrock.
[4] Soils are subject to flooding.
[5] Water table is perched above the fragipan.

TABLE 6.—*Interpretations of*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil that may have in the first

Soil series and map symbols	Suitability as a source of—		Soil features affecting—	
			Ponds	
	Topsoil	Road fill	Reservoir area	Embankment
Allegheny: AlB, AlC	Fair: moderate clay content.	Poor: A-6 or A-7 material.	Texture of substratum variable; seepage in places.	Fair to good compaction characteristics.
AsD	Poor: stoniness; slope	Poor: A-6 or A-7 material.	Texture of substratum variable; seepage in places.	Fair to good compaction characteristics.
Baxter: BaC, BaD, BbC3.	Poor: cherty	Poor: A-6 or A-7 material; moderate shrink-swell potential.	Subject to excessive seepage through very cherty substratum or through cavernous bedrock in areas of karst topography.	Fair to good compaction characteristics; medium to high compressibility.
Bonnie: Bo	Poor: poorly drained	Poor: A-4 or A-6 material; poorly drained.	Nearly level soils; seasonal high water table.	Some hazard of piping
Clifty: Cf	Poor: gravelly	Fair: A-2 or A-4 material.	Very rapid permeability in subsoil.	Some hazard of piping
Colbert: CoC, CpC3	Poor: clayey below depth of 7 inches.	Poor: A-6 or A-7 material; high shrink-swell potential; poor compaction characteristics.	Hazard of excessive seepage in places through crevices in bedrock.	Very poor compaction characteristics; large boulders; limited availability in places; high compressibility.
Crider: CrA, CrB, CrC	Good	Poor: A-6 or A-7 material.	Moderate permeability	Medium to high compressibility.
Cuba: Cu	Good	Fair to poor: A-4 or A-6 material.	Moderate permeability; nearly level; excessive seepage in substratum.	Hazard of piping and sliding; high erodibility.
Cumberland: CvB, CvC, CwC3.	Fair: clayey below depth of about 12 inches.	Poor: A-6 or A-7 material; moderate shrink-swell potential.	Moderate permeability	Fair to poor compaction characteristics; high compressibility.
Dunning: Du	Poor: clayey at depth of about 12 inches; poorly drained.	Poor: A-7 material; moderate shrink-swell potential; seasonal high water table at depth of 0 to 6 inches.	Nearly level; seasonal high water table.	Medium to high compressibility; fair to poor compaction characteristics.
Elk: ElA, ElB, ElC	Fair: moderate clay content.	Fair: A-4 material	Moderate permeability	Material above depth of 48 inches has medium to low shear strength.
Epley: EpB, EpC	Fair: moderate clay content.	Poor: A-6 or A-7 material.	Features generally favorable.	Material below depth of 24 inches has poor workability and fair stability.
Fredonia: FeC	Poor: clayey and rocky	Poor: A-7 material; rock outcrops; bedrock at depth of 18 to 42 inches.	Hazard of excessive seepage due to creviced rock at depth of 18 to 42 inches.	Very rocky; limited availability; poor suitability; fair compaction characteristics.

engineering properties of the soils

different properties and limitations. For this reason it is necessary to follow carefully the instructions for referring to other series that appear column]

Soil features affecting—Continued			
Drainage for crops and pasture	Irrigation	Terraces and diversions	Grassed waterways
Not needed	Moderate permeability; well drained.	Stony in some places	Stony in some places.
Not needed	Moderate permeability; well drained.	Slopes of more than 12 percent; stoniness.	Slopes of more than 12 percent; stoniness.
Not needed	Moderate permeability; moderate to rapid runoff; well drained.	Soil is cherty; subsoil is clayey and difficult to work.	Some slopes of more than 12 percent; clayey subsoil; high chert content.
Slow permeability below depth of 2½ to 3 feet; seasonal high water table at depth of 0 to ½ foot; hazard of flooding.	Slow permeability; slow runoff; poorly drained.	Not needed	Poorly drained; seasonal high water table; soils on bottom lands.
Not needed	Moderately rapid permeability; slow runoff; well drained.	Not needed	Gravelly.
Very slow permeability	Very slow permeability; slow to medium runoff; moderately well drained.	Some areas where bedrock is at depth of 24 to 36 inches have rock outcrops; clayey subsoil; very slow permeability in subsoil.	Poor workability; rock outcrop in places; clayey; high erodibility.
Not needed	Moderate permeability; medium runoff; well drained.	Features generally favorable	Features generally favorable.
Not needed	Moderate permeability; slow to medium runoff; well drained.	Not needed	Features generally favorable.
Not needed	Moderate permeability; medium runoff; well drained.	Clayey subsoil; difficult to work.	Clayey subsoil.
Slow permeability; seasonal high water table at depth of 0 to 6 inches; hazard of flooding.	Slow permeability; slow to very slow runoff; very poorly drained.	Not needed	Clayey; poorly drained.
Not needed	Moderate permeability; medium runoff; well drained.	Features generally favorable	Features generally favorable.
Slow permeability below depth of 24 inches.	Slow permeability; slow or medium runoff; moderately well drained.	Clayey subsoil; difficult to work; slow permeability below depth of about 24 inches.	Clayey subsoil; seepy in places.
Not needed	Moderately slow permeability; rapid runoff; well drained.	Bedrock at depth of 18 to 42 inches; rock outcrops; slow permeability; clayey.	Bedrock at depth of 18 to 42 inches; rock outcrops; clayey subsoil.

TABLE 6.—*Interpretations of engineering*

Soil series and map symbols	Suitability as a source of—		Soil features affecting—	
			Ponds	
	Topsoil	Road fill	Reservoir area	Embankment
Frondorf: FrC, FrD, FsF.	Poor: coarse fragments; slope.	Fair: A-4 material; bedrock at depth of 18 to 42 inches.	Moderate permeability; fractured rock with seepage potential at depth of 18 to 42 inches.	Bedrock at depth of 18 to 42 inches; stoniness in some areas.
Gullied land: Gu. All characteristics variable; requires onsite investigation.				
Hartsells: HaC	Fair: coarse fragments; moderate clay content.	Fair to poor: A-4, A-6, or A-7 material; bedrock at depth of 18 to 42 inches.	Moderately rapid permeability; fractured rock at depth of 18 to 42 inches.	Bedrock at depth of 18 to 42 inches; hazard of piping.
Johnsburg: Jo	Poor: revegetation of borrow area is difficult.	Fair to poor: A-4 or A-6 material; somewhat poorly drained.	Nearly level; limited to dug ponds; seasonal high water table.	Medium to low shear strength; some hazard of piping.
Karnak: Ka	Poor: clayey; poorly drained.	Poor: A-7 material; high shrink-swell potential; poorly drained.	Nearly level; seasonal high water table.	Poor workability and stability; high shrink-swell potential; medium to high compressibility.
Lawrence: La	Poor: revegetation of borrow area is difficult.	Poor: A-6 or A-7 material; somewhat poorly drained.	Nearly level; limited to dug ponds; seasonal high water table.	Medium to low shear strength; medium compressibility.
Lindside: Ld	Good	Fair to poor: A-4 or A-6 material; moderately well drained.	Moderate permeability; nearly level.	Hazard of piping; medium to low shear strength; fair compaction characteristics.
Linker: LnB, LnC	Fair: moderate clay content; bedrock at depth of 24 to 48 inches.	Fair to poor: A-4 or A-6 material; bedrock at depth of 24 to 48 inches.	Moderately rapid permeability.	Bedrock at depth of 24 to 48 inches; medium to low shear strength.
Melvin: Me	Poor: poorly drained	Poor: A-4 or A-6 material; poorly drained.	Moderate permeability; nearly level; subject to excessive seepage in substratum.	Some hazard of piping; medium to low shear strength; fair compaction characteristics.
Newark: Ne	Good	Fair to poor: A-4 or A-6 material; somewhat poorly drained.	Subject to excessive seepage in substratum; nearly level; seasonal high water table.	Some hazard of piping; medium to low shear strength; fair compaction characteristics.
Nicholson: NhA, NhB, NhC.	Fair: moderate clay content.	Fair to poor: A-4 or A-6 material; moderately well drained.	Features generally favorable.	Medium to low shear strength; fair compaction characteristics.
Nolin: No	Good	Fair to poor: A-4 or A-6 material.	Hazard of excessive seepage in many places due to highly permeable substratum; nearly level.	Hazard of piping; medium to low shear strength; fair compaction characteristics.

properties of the soils—Continued

Soil features affecting—Continued			
Drainage for crops and pasture	Irrigation	Terraces and diversions	Grassed waterways
Not needed	Moderate permeability; medium to very rapid runoff; well drained.	Some slopes of more than 12 percent; stoniness in places.	Some slopes of more than 12 percent; stoniness in places; bedrock at depth of 18 to 42 inches.
Not needed	Moderately rapid permeability; medium runoff; well drained.	Bedrock at depth of 18 to 42 inches.	Bedrock at depth of 18 to 42 inches.
Very slow permeability; fragipan at depth of 18 to 24 inches; perched water table at depth of 6 to 18 inches.	Very slow permeability; slow or very slow runoff; somewhat poorly drained.	Not needed	Seepage may occur from side slopes; somewhat poorly drained.
Slow permeability; seasonal high water table at depth of 0 to 6 inches; hazard of flooding.	Slow permeability; slow runoff; well drained.	Not needed	Seasonal high water table; poorly drained.
Slow permeability in fragipan at depth of 18 to 30 inches; perched water table at depth of 6 to 18 inches.	Slow permenbility; slow runoff; somewhat poorly drained.	Not needed	Seasonal high water table; seepage from side slopes.
Moderate permeability; seasonal high water table at depth of 18 to 36 inches; hazard of flooding.	Moderate permeability; medium runoff; moderately well drained.	Not needed	Features generally favorable.
Not needed	Moderately rapid permeability; moderate to rapid runoff; well drained.	Bedrock at depth of 24 to 48 inches; moderately rapid permeability.	Bedrock at depth of 24 to 48 inches.
Moderate permeability; seasonal high water table at depth of 0 to 6 inches; hazard of flooding.	Moderate permeability; slow runoff; poorly drained.	Not needed	Seasonal high water table; poorly drained.
Moderate permeability; seasonal high water table at depth of 6 to 18 inches; hazard of flooding.	Moderate permeability; very slow runoff; somewhat poorly drained.	Not needed	Seasonal high water table; somewhat poorly drained.
Slow permeability in fragipan at depth of 18 to 30 inches; perched water table at depth of about 18 to 30 inches.	Moderate permeability above fragipan; slow permeability in fragipan; medium runoff; moderately well drained.	Slow permeability in fragipan at depth of 18 to 30 inches.	Seepage from side slopes.
Not needed	Moderate permeability; slow runoff; well drained.	Not needed	Features generally favorable.

TABLE 6.—*Interpretations of engineering*

Soil series and map symbols	Suitability as a source of—		Soil features affecting—	
			Ponds	
	Topsoil	Road fill	Reservoir area	Embankment
Pembroke: PeA, PeB, PeC, PfC3.	Fair: moderate clay content.	Poor: A-6 or A-7 material; moderate shrink-swell potential.	Moderate permeability; underlain by cavernous limestone.	Medium to low shear strength; medium to high compressibility.
Pickwick: PkB, PkC, PlC3.	Fair: moderate clay content.	Poor: A-6 or A-7 material.	Moderate permeability	Medium to low shear strength; medium to high compressibility.
Robertsville: Ro	Poor: poorly drained	Poor: A-4 or A-6 material; poorly drained.	Nearly level; limited to dug ponds; seasonal high water table.	Hazard of piping; medium to low shear strength; fair compaction characteristics.
*Rock outcrop: Rx. Poorly suited to all uses; for Fredonia part, see Fredonia series; for Colbert part, see Colbert series.				
Sadler: SaA, SaB	Fair: moderate clay content.	Fair to poor: A-4 or A-6 material; moderately well drained.	Features generally favorable.	Medium to low shear strength; medium compressibility.
Steff: St	Good	Fair to poor: A-4 or A-6 material; moderately well drained.	Moderate permeability; subject to seepage in substratum; nearly level; seasonal high water table.	Hazard of piping; fair to poor compaction characteristics.
*Talbott: TaB, TaC, TaD, TbD3, TcD, TcF. For Colbert part of TcD and TcF, see Colbert series.	Poor: clayey below depth of 6 inches.	Poor: A-7 material; moderate shrink-swell potential.	Limestone bedrock at depth of 24 to 60 inches may allow seepage.	Bedrock at depth of 24 to 60 inches; high compressibility; fair to poor compaction characteristics; good core material.
Wellston: WeB, WeC	Fair: moderate clay content.	Poor: A-6 or A-7 material.	Moderate permeability	Medium to low shear strength; medium compressibility; fair compaction characteristics.
Zanesville: ZaB, ZaC	Fair: moderate clay content; moderate shrink-swell potential.	Poor: A-6 or A-7 material.	Features generally favorable.	Medium to low shear strength; medium compressibility; fair compaction characteristics.

properties of the soils—Continued

Soil features affecting—Continued			
Drainage for crops and pasture	Irrigation	Terraces and diversions	Grassed waterways
Not needed	Moderate permeability; medium runoff; well drained.	Features generally favorable	Features generally favorable.
Not needed	Moderate permeability; medium runoff; well drained.	Features generally favorable	Features generally favorable.
Very slow permeability in fragipan at depth of 18 to 36 inches; perched water table at depth of 0 to 6 inches.	Moderate permeability above fragipan; very slow permeability in fragipan; slow runoff; poorly drained.	Not needed	Poorly drained; seasonal high water table; seepy in places.
Slow permeability in fragipan at depth of 18 to 30 inches; perched water table at depth of 18 to 24 inches.	Moderate permeability above fragipan; slow permeability in fragipan; slow to medium runoff; moderately well drained.	Slow permeability in fragipan at depth of 18 to 30 inches; nearly level slopes in places.	Fragipan and seasonal high water table at depth of 18 to 30 inches; seepage from side slopes.
Moderate permeability; seasonal high water table at depth of 18 to 24 inches; hazard of flooding.	Moderate permeability; slow runoff; moderately well drained.	Not needed	Features generally favorable.
Not needed	Moderately slow permeability; moderate to rapid runoff; well drained.	Bedrock at depth of 24 to 60 inches; clayey; high erodibility; moderately slow permeability; some slopes of more than 12 percent.	Bedrock at depth of 24 to 60 inches; clayey subsoil; some slopes of more than 12 percent.
Not needed	Moderate permeability; medium runoff; well drained.	Features generally favorable	Features generally favorable.
Slow permeability in fragipan below depth of 24 to 30 inches.	Moderate permeability above fragipan; slow permeability in fragipan; medium runoff; well drained to moderately well drained.	Slow permeability in fragipan at depth of about 24 to 30 inches.	Some seepage from side slopes.

TABLE 7.—*Engineering*

[Tests made by Kentucky Department of Highways Research Laboratory, Lexington, in cooperation with the Bureau of

Soil name and location of sample	Parent material	Depth from surface	Moisture-density data [1]	
			Maximum dry density	Optimum moisture
		Inches	*Lb/cu ft*	*Percent*
Baxter cherty silt loam: North side of State Highway 102, about 1 mile east of Keysburg; approximately 10 miles southwest of Russellville. (Modal)	Cherty limestone	0–9 23–32 48–75	109 103 103	17 22 22
Colbert silt loam: 50 feet southeast of gravel road, 0.75 mile southwest of intersection with U.S. Highway 431, 2.5 miles northwest of Lewisburg. (Modal)	Argillaceous limestone.	16–27 27–39	91 95	25 24
Crider silt loam: 50 feet southwest of State Highway 1039, about 1.1 miles southeast of intersection with U.S. Highway 68. (Modal)	Loess over limestone residuum.	12–30 44–76	110 108	16 19
Cumberland silt loam: Along State Highway 765, about 2.2 miles south of intersection with State Highway 664. (Modal)	Limestone	17–44 44–57	90 95	31 28
Elk silt loam: Southeast side of U.S Highway 79 on the west side of Dry Fork Creek about 5.1 miles southwest of Russellville. (Modal)	Alluvium from limestone.	13–20 27–48	115 116	14 14
Pembroke silt loam: 450 yards west of farmhouse at end of private road, 1 mile northwest of State Highway 663. Entrance to private road is about 2 miles northeast of intersection of State Highways 100 and 663, about 4 miles northeast of Corinth. (Modal)	Limestone	0–9 15–27 41–84	109 109 100	15 18 21
Pickwick silt loam: West side of State Highway 431, 4.5 miles south of Russellville	Limestone with loess mantle.	17–33 58–98	112 107	16 19
Sadler silt loam: 75 feet northeast of State Highway 103, 0.1 mile northwest of intersection with State Highway 1038, about 5.5 miles northwest of Auburn.	Sandstone	7–19 23–38 48–78	103 110 109	15 16 17
Talbott silt loam: 75 feet west of a gravel road, 0.2 mile north of intersection with U.S. Highway 68, which is 1 mile west of Auburn.	Limestone	11–26 26–37	97 86	21 32
Wellston silt loam: 150 feet west of farmhouse on private road, 0.3 mile west of State Highway 675. Entrance is 2.7 miles north of intersection of State Highways 103 and 675, about 4 miles north of Auburn.	Sandstone	0–12 27–38	110 98	13 25

[1] Based on AASHO Designation: T 99–57 (*2*).

[2] Mechanical analysis according to AASHO Designation: T 88–57 (*2*). Results by this procedure may differ somewhat from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method, and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method, and the material coarser than 2

test data

Public Roads, in accordance with standard procedures of the American Association of State Highway Officials (AASHO)]

Mechanical analysis [2]										Liquid limit	Plasticity index	Classification	
Percentage passing sieve—						Percentage smaller than—						AASHO	Unified
3/8 in	No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 60 (0.25 mm)	No. 200 (0.074 mm)	0.05 mm	0.02 mm	0.005 mm	0.002 mm	Percent			
100	92	89	86	85	82	74	56	28	20	34	12	A-6(9)	CL-ML
100	70	69	67	66	63	60	52	38	32	57	37	A-7-6(21)	CH
[3] 93	93	87	84	81	77	72	69	56	49	69	45	A-7-6(36)	CH
--------	100	97	97	97	95	91	83	63	55	76	35	A-7-5(43)	MH
100	90	76	74	74	74	65	56	44	34	71	35	A-7-5(29)	MH-CH
--------	100	94	94	93	82	79	74	36	26	38	19	A-6(15)	CL
--------	100	98	97	96	78	72	64	42	35	47	29	A-7-6(22)	CL
100	81	78	78	78	77	74	71	61	57	60	11	A-7-5(13)	MH
100	85	85	85	85	83	80	73	59	54	59	20	A-7-5(21)	MH
--------	--------	100	99	98	89	82	60	30	22	29	10	A-4(8)	CL
--------	--------	100	99	97	82	78	60	20	16	23	4	A-4(1)	CL-ML
--------	--------	--------	100	99	95	86	60	25	16	29	7	A-4(6)	CL-ML
--------	--------	100	99	99	96	92	72	38	31	43	18	A-7-6(20)	CL-ML
--------	100	91	91	90	83	80	71	45	38	50	19	A-7-5(18)	ML or MH
--------	100	99	99	98	82	76	63	34	29	37	14	A-6(11)	CL-ML
--------	100	97	96	95	72	66	59	42	39	45	12	A-7-5(9)	ML
--------	100	99	98	97	93	88	68	29	20	32	10	A-4(9)	CL-ML
--------	100	94	92	92	85	77	56	27	16	31	10	A-4(8)	CL
100	97	96	95	94	86	76	56	29	24	33	12	A-6(10)	CL
100	97	92	90	89	72	68	61	49	45	57	30	A-7-6(22)	CH
--------	--------	100	99	98	91	81	72	66	62	94	43	A-7-5(51)	MH
--------	100	99	99	98	80	76	56	15	9	[4] NP	[4] NP	A-4(0)	ML
100	98	88	87	87	62	57	51	46	42	59	30	A-7-6(17)	CH-MH

millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analysis data used in this table are not suitable for naming textural classes for soils.

[3] 94 percent passed the 1-inch sieve; 94 percent passed the ¾-inch sieve.

[4] NP=Nonplastic.

Use of the Soils for Town and Country Planning

The soils are a very important consideration in planning most town and country construction. The interpretations in this section of the survey point out soil-related limitations and hazards that can be expected with these kinds of uses. The most severe limitations listed can be overcome if the cost involved can be justified. The information in this section is not intended to eliminate the need for onsite investigations for specific uses, but it can serve as a guide for screening sites and for planning more detailed investigations.

Table 8 shows the estimated most severe degree of limitation and the kinds of limitations for 11 different uses of the soils. Limitations are *slight* if they are minor and are easy to overcome. They are *moderate* if careful planning, design, and management are required to overcome them. Cost of corrective measures is an important consideration. Limitations are *severe* if they are very difficult to overcome or if the cost of corrective measures is too high to justify the use.

The kinds of limitations, expressed in terms of soil characteristics or properties, are shown only for the moderate and severe ratings. Some of the kinds of limitations are expressed in terms that may not be found in a standard dictionary or that have special meaning. These are defined in the Glossary at the back of this survey.

Specific soil characteristics vary in importance in rating the soils for different uses. The ratings in table 8 are explained in the paragraphs that follow.

Ratings for septic tank filter fields are based on soil permeability, depth to seasonal high water table, depth to bedrock, surface rockiness and stoniness, slope, and flooding hazard. Pollution hazard to a water supply source was not considered in making the ratings, because onsite investigation is needed to determine pollution hazards.

Sewage lagoons are shallow ponds that are used for disposal of sewage by oxidation. Ratings of soils for this use are based on permeability (basin floor), slope, depth to bedrock, quantity of coarse fragments less than 10 inches in diameter, surface stoniness, kind of soil material at site, flooding hazard, and organic-matter content.

Building locations considered are for dwellings and service buildings of three stories or less that have basements. The ratings of soils for this use are based on depth to seasonal high water table, depth to bedrock, slope, surface rockiness and stoniness, flooding hazard, and shrink-swell potential. Slope is more restrictive for subdivision locations than for other building sites.

The soils are rated for shallow excavations that extend to a depth of 5 or 6 feet. This rating can be used as a guide in determining sites for cemeteries and underground utility lines, such as sewers, pipelines, and cables. The limitations are based on properties that affect the ease of digging and backfilling. These are natural drainage (wetness), slope, depth to bedrock, dominant texture to a depth of 5 feet, rockiness, stoniness, and flooding hazard.

Campsites, tents and small trailers, are areas of intensive use. Ratings for this use are based on depth to bedrock, permeability, depth to seasonal high water table, surface rockiness and stoniness, texture of the surface layer, and flooding hazard. Slope is more restrictive for trailer parks than for tent areas.

Soil ratings for local roads and streets are based on soil properties that affect the design and construction of streets and roads, exclusive of highways. Properties considered are depth to seasonal high water table, depth to bedrock, slope, flooding hazard, rockiness, stoniness, and traffic-supporting capacity. Traffic-supporting capacity is an indication of the ability of the subgrade to support loads. It is based on the Unified classification of the soils.

Athletic fields require intensive use of the soils for sports, such as baseball, football, and volleyball, that normally require the finished area to be nearly level and able to support heavy foot traffic. Soil ratings are based on depth to seasonal high water table, permeability, slope, depth to bedrock, surface rockiness and stoniness, surface texture, and flooding hazard.

Play and picnic areas are subject to less intensive use than athletic fields. Soil ratings for this use are based on depth to seasonal high water table, slope, depth to bedrock, surface stoniness and rockiness, texture of the surface layer, and flooding hazard. These factors are less restrictive for play areas and picnic areas than for athletic fields.

In rating soils for lawns and landscaping, it is assumed that soil material at the site will be used. No importation of fill or topsoil is considered in the ratings. They are based on depth to seasonal high water table, slope, depth to bedrock, surface stoniness and rockiness, texture of the surface layer, and flooding hazard.

Ratings of the soils for sanitary landfill apply to their suitability for use as disposal areas for trash and garbage. It is assumed that the operation will be by the trench method. No importation of fill or cover material is considered in the ratings. They are based on depth to seasonal high water table, permeability, slope, depth to bedrock, surface rockiness and stoniness, texture of the surface layer, and flooding hazard.

The ratings of soils for paths and trails are for nonintensive uses, such as cross-country hiking and bridle paths. It is assumed that the areas will be used as they occur in nature. The ratings are based on wetness, slope, surface rockiness and stoniness, texture of the surface layer, and flooding hazard.

Formation and Classification of the Soils

This section describes the factors of soil formation and their relation to the soils of Logan County. It also briefly explains the system of classification and shows the placement of the soil series in the higher categories of that classification.

Formation of Soils

The characteristics of the soil at any given place depend on the climate, the physical and chemical composition of parent material, the relief, the plant and animal life, and time. Soil is formed by the interaction of these

five factors. The relative importance of each factor differs from one area to another. In some areas one factor may dominate in the formation of soil characteristics, and in other areas another factor may dominate. Climate and plant and animal life are not likely to vary much over an area the size of this county, but there may be many local differences in relief and parent material.

Since the interrelationships among the five factors are complex, the effect of any one factor is hard to determine. Some of the ways in which each of these factors has influenced soil formation in Logan County are described in the paragraphs that follow.

Climate

Climate affects the physical, chemical, and biological relationships in the soil. It influences the kind and number of plants and animals, the weathering of rocks and minerals, the erosion, and the rate of soil formation.

The soils of Logan County formed in a temperate, moist climate. Since the soils were moist and subject to leaching during formation, many of the soluble bases have been largely leached out of the solum, and clay minerals have moved from the surface layer into the subsoil. As a result, many of the soils are acid and have a relatively high content of clay in the subsoil. Among such soils are Wellston and Crider soils. Climate has been a relatively uniform factor within the county; it accounts for only slight differences among the soils.

Parent material

Parent material is the unconsolidated mass from which a soil formed. The soils in Logan County formed mostly in thin loess, material weathered from rocks in place, and alluvium washed from these kinds of soils and deposited along streams. Most of the surface rock formations are siltstone, sandstone, shale, and limestone. Most gently sloping and sloping soils in Logan County have 2 to 4 feet of loess, or windblown silty material, over the residual parent material. Wellston and Crider soils are examples.

The chemical composition, mineral content, and texture of the soils in the county have been influenced greatly by the kind of parent material in which the soils formed. For example, Frondorf soils formed in material weathered mostly from sandstone and are coarser textured than Colbert soils, which formed in material weathered mostly from argillaceous limestone. Cuba and other alluvial soils have the same general composition as the surrounding soils on uplands from which their parent material was derived.

Relief

The relief in Logan County is varied. The maximum difference in elevation between the valleys and the adjacent hilltops generally is about 300 feet, but in a few places it is about 500 feet. Slopes range from nearly level to steep.

Most of the county consists of gently sloping to sloping soils on narrow to moderately broad ridgetops and strongly sloping to steep soils on sides of ridges. Little soil material is lost from the ridgetops through erosion, because much of the rain enters the soils and percolates downward through the solum. As a result, most soils on ridgetops are deep over bedrock and have well-defined horizons. Examples are the Zanesville and Sadler soils, which have a fragipan, and the Wellston soils, which do not.

Steep soils on sides of ridges are more likely to be shallow, because much of the rain runs off instead of percolating through the soil. As a result, erosion has been rapid and leaching has been minimal. These soils generally have more weakly defined horizons and are shallower than soils on bottom lands. Examples are the Frondorf and Talbott soils.

Relief modifies the effects of climate, although temperature and rainfall are about the same throughout the county.

Plant and animal life

The vegetation that grows during the period of soil formation influences the kind of soil that is formed. The native vegetation of Logan County was mostly hardwood forest.

Soils that formed under forest and were undisturbed during formation have a thin, dark-colored surface layer and leached, lighter colored subsurface layers. Examples are the Wellston, Zanesville, and Crider soils. Soils that formed under grass normally have a thicker surface layer and contain more organic matter than soils that formed under forest. Dunning soils, which are inextensive in Logan County, probably formed under grass, cane, or both.

The organisms that live in the soil serve an important function in soil formation by breaking down plant and animal residues. When these residues are broken down, minerals are released, and humus, which aids in the formation of soil structure, is formed.

Man also has had some influence in the formation of soils. He influences future soil development by such practices as cultivation, irrigation, drainage, introduction of new plants, and removal of part of the original surface layer.

Time

The effects of the active factors of soil formation—climate and living organisms—depend largely on the length of time the processes of soil formation have been in progress. Because of the influence of parent material and relief, this may be difficult to determine. If the influence of the active factors has been fairly uniform, the relative age of a soil can be determined by the degree of development of its genetic horizons. Soils that show little or no evidence of horizon development are considered to be young soils; those that have well-differentiated horizons are considered to be mature.

Nolin and Lindside soils, which formed in alluvium recently deposited on flood plains, are examples of young soils. Nearly level to sloping Zanesville and Sadler soils formed in 2 to 4 feet of loess and the underlying residuum on uplands. They have well-differentiated horizons and are examples of mature soils.

Classification of the Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their re-

TABLE 8.—*Limitations of the soils*

Soils	Estimated degree and kind of limitations for—				
	Septic tank absorption fields	Sewage lagoons	Sites for buildings with basements	Shallow excavations	Campsites (tents and small trailers)
Allegheny loam, 2 to 6 percent slopes.	Slight	Moderate: moderate permeability; slope.	Slight	Moderate: clay loam texture.	Slight
Allegheny loam, 6 to 12 percent slopes.	Moderate: depth to bedrock; slope.	Severe: slope	Moderate: slope	Moderate: clay loam texture; slope.	Moderate: slope
Allegheny stony loam, 12 to 20 percent slopes.	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope
Baxter cherty silt loam, 6 to 12 percent slopes.	Moderate: slope	Severe: slope	Moderate: moderate shrink-swell potential; slope.	Severe: cherty clay texture.	Moderate: slope; cherty.
Baxter cherty silt loam, 12 to 20 percent slopes.	Severe: slope	Severe: slope	Severe: slope	Severe: cherty clay texture; slope.	Severe: slope; cherty.
Baxter cherty silty clay loam, 6 to 12 percent slopes, severely eroded.	Moderate: slope	Severe: slope	Moderate: moderate shrink-swell potential; slope.	Severe: cherty clay texture.	Moderate: slope; cherty; silty clay loam surface layer.
Bonnie silt loam	Severe: low permeability; seasonal high water table; flooding.	Severe: flooding	Severe: seasonal high water table; flooding.	Severe: poorly drained; flooding.	Severe: seasonal high water table; flooding.
Clifty gravelly silt loam.	Severe: flooding	Severe: moderately rapid permeability; flooding.	Severe: flooding	Severe: flooding	Severe: flooding
Colbert silt loam, 6 to 12 percent slopes.	Severe: very slow permeability.	Severe: slope	Severe: high shrink-swell potential.	Severe: clay texture.	Moderate: slope
Colbert silty clay, 6 to 12 percent slopes, severely eroded.	Severe: very slow permeability.	Severe: slope	Severe: high shrink-swell potential.	Severe: clay texture.	Severe: silty clay surface layer; slope.
Crider silt loam, 0 to 2 percent slopes.	Slight	Moderate: moderate permeability.	Slight	Slight	Slight
Crider silt loam, 2 to 6 percent slopes.	Slight	Moderate: moderate permeability; slope.	Slight	Slight	Slight
Crider silt loam, 6 to 12 percent slopes.	Moderate: slope	Severe: slope	Moderate: slope	Moderate: slope	Moderate: slope
Cuba silt loam	Severe: flooding	Severe: flooding	Severe: flooding	Severe: flooding	Moderate: no flooding during season of use.
Cumberland silt loam, 2 to 6 percent slopes.	Slight	Moderate: moderate permeability; slope.	Moderate: moderate shrink-swell potential.	Severe: clay texture.	Slight
Cumberland silt loam, 6 to 12 percent slopes.	Moderate: slope	Severe: slope	Moderate: moderate shrink-swell potential; slope.	Severe: clay texture.	Moderate: slope

See footnote at end of table.

for town and country planning

Estimated degree and kind of limitations for—Continued					
Local roads and streets	Athletic fields	Play and picnic areas	Lawns and landscaping	Sanitary landfills [1] (trench method)	Paths and trails
Moderate: poor traffic-supporting capacity.	Moderate: slope	Slight	Slight	Moderate: clay loam texture.	Slight.
Moderate: slope; poor traffic-supporting capacity.	Severe: slope	Moderate: slope	Moderate: slope	Moderate: clay loam texture.	Slight.
Severe: slope; poor traffic-supporting capacity.	Severe: slope	Severe: slope; stoniness.	Severe: slope	Severe: depth to bedrock; slope.	Moderate: slope.
Moderate: slope; poor traffic-supporting capacity.	Severe: slope	Moderate: slope; coarse fragments.	Moderate: slope	Severe: clay texture.	Slight.
Severe: slope	Severe: slope	Severe: slope; coarse fragments.	Severe: slope	Severe: clay texture.	Moderate: slope.
Moderate: slope; poor traffic-supporting capacity.	Severe: slope	Moderate: slope; coarse fragments; silty clay loam texture.	Severe: slope; severe erosion.	Severe: clay texture.	Slight.
Severe: seasonal high water table; flooding.	Severe: seasonal high water table; flooding.	Severe: seasonal high water table; flooding.	Severe: seasonal high water table; flooding.	Severe: seasonal high water table; flooding.	Severe: seasonal high water table; flooding.
Severe: flooding	Severe: flooding	Moderate: flooding; coarse fragments.	Severe: flooding	Severe: flooding	Slight.
Severe: high shrink-swell potential; poor traffic-supporting capacity.	Severe: slope; very slow permeability.	Moderate: slope	Moderate: slope	Severe: depth to bedrock; clay texture.	Slight.
Severe: high shrink-swell potential; poor traffic-supporting capacity.	Severe: slope; clay texture; very slow permeability.	Severe: silty clay surface layer; slope.	Severe: slope; severe erosion.	Moderate: depth to bedrock; clay texture.	Severe: silty clay surface layer.
Moderate: poor traffic-supporting capacity.	Slight	Slight	Slight	Slight	Slight.
Moderate: poor traffic-supporting capacity.	Moderate: slope	Slight	Slight	Slight	Slight.
Moderate: slope; poor traffic-supporting capacity.	Severe: slope	Moderate: slope	Moderate: slope	Slight	Slight.
Severe: flooding	Severe: flooding	Moderate: flooding	Moderate: flooding	Severe: flooding	Slight.
Severe: poor traffic-supporting capacity.	Moderate: slope	Slight	Slight	Severe: clay texture.	Slight.
Severe: poor traffic-supporting capacity.	Severe: slope	Moderate: slope	Moderate: slope	Severe: clay texture.	Slight.

TABLE 8.—*Limitations of the soils*

Soils	Estimated degree and kind of limitations for—				
	Septic tank absorption fields	Sewage lagoons	Sites for buildings with basements	Shallow excavations	Campsites (tents and small trailers)
Cumberland silty clay loam, 6 to 12 percent slopes, severely eroded.	Moderate: slope.	Severe: slope.	Moderate: moderate shrink-swell potential; slope.	Severe: clay texture.	Moderate: slope; silty clay loam surface layer.
Dunning silty clay loam.	Severe: slow permeability; seasonal high water table; flooding.	Severe: flooding.	Severe: seasonal high water table; flooding.	Severe: very poorly drained; flooding.	Severe: seasonal high water table; flooding.
Elk silt loam, 0 to 2 percent slopes.	Slight.	Moderate: moderate permeability.	Slight.	Slight.	Slight.
Elk silt loam, 2 to 6 percent slopes.	Slight.	Moderate: moderate permeability; slope.	Slight.	Slight.	Slight.
Elk silt loam, 6 to 12 percent slopes.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Moderate: slope.
Epley silt loam, 2 to 6 percent slopes.	Severe: slow permeability; seasonal high water table.	Moderate: slope.	Severe: seasonal high water table.	Severe: clay texture.	Moderate: slow permeability.
Epley silt loam, 6 to 12 percent slopes.	Severe: slow permeability; seasonal high water table.	Severe: slope.	Severe: seasonal high water table.	Severe: clay texture.	Moderate: slow permeability; slope.
Fredonia rocky silty clay loam, 2 to 12 percent slopes.	Severe: slow permeability; depth to bedrock.	Severe: depth to bedrock; slope.	Severe: depth to bedrock.	Severe: depth to bedrock; clay texture.	Moderate: rockiness; slope.
Frondorf silt loam, 6 to 12 percent slopes.	Severe: depth to bedrock.	Severe: depth to bedrock; slope.	Severe: depth to bedrock.	Severe: depth to bedrock.	Moderate: slope.
Frondorf silt loam, 12 to 20 percent slopes.	Severe: depth to bedrock; slope.	Severe: depth to bedrock; slope.	Severe: depth to bedrock; slope.	Severe: depth to bedrock; slope.	Severe: slope.
Frondorf stony complex, 12 to 50 percent slopes.	Severe: depth to bedrock; slope.	Severe: depth to bedrock; slope.	Severe: depth to bedrock; slope.	Severe: depth to bedrock; slope.	Severe: slope; stoniness.
Gullied land. Not rated; requires onsite investigation.					
Hartsells loam, 6 to 12 percent slopes.	Severe: depth to bedrock.	Severe: moderately rapid permeability; slope.	Severe: depth to bedrock.	Severe: depth to bedrock.	Moderate: slope.

See footnote at end of table.

for town and country planning—Continued

Estimated degree and kind of limitations for—Continued					
Local roads and streets	Athletic fields	Play and picnic areas	Lawns and landscaping	Sanitary landfills [1] (trench method)	Paths and trails
Severe: poor traffic-supporting capacity.	Severe: slope	Moderate: slope; silty clay loam texture.	Severe: slope; severe erosion.	Severe: clay texture.	Moderate: silty clay loam layer.
Severe: seasonal high water table; flooding.	Severe: seasonal high water table; flooding.	Severe: seasonal high water table; flooding.	Severe: seasonal high water table; flooding.	Severe: seasonal high water table; flooding; clay texture.	Severe: seasonal high water table; very poorly drained.
Moderate: poor traffic-supporting capacity.	Slight	Slight	Slight	Slight: severe in areas where the substratum is gravelly.	Slight.
Moderate: poor traffic-supporting capacity.	Moderate: slope	Slight	Slight	Slight: severe in areas where the substratum is gravelly.	Slight.
Moderate: poor traffic-supporting capacity; slope.	Severe: slope	Moderate: slope	Moderate: slope	Slight: severe in areas where the substratum is gravelly.	Slight.
Moderate: seasonal high water table; poor traffic-supporting capacity.	Moderate: slow permeability; slope.	Slight	Slight	Severe: clay texture; depth to bedrock.	Slight.
Moderate: seasonal high water table; poor traffic-supporting capacity; slope.	Severe: slow permeability; slope.	Moderate: slope	Moderate: slope	Severe: clay texture; depth to bedrock.	Slight.
Moderate to severe; rockiness; slope; poor traffic-supporting capacity.	Severe: rockiness; slope.	Moderate: rockiness; slope.	Moderate: rockiness; slope.	Severe: depth to bedrock.	Moderate: silty clay loam surface layer.
Moderate: depth to bedrock; slope.	Severe: slope	Moderate: slope	Moderate: depth to bedrock; slope.	Severe: depth to bedrock.	Slight.
Severe: depth to bedrock; slope.	Severe: slope	Severe: slope	Severe: slope	Severe: depth to bedrock.	Moderate: slope.
Severe: depth to bedrock; slope.	Severe: slope; stoniness.	Severe: slope; stoniness.	Severe: slope; stoniness.	Severe: depth to bedrock; slope.	Severe: slope.
Moderate: depth to bedrock; slope.	Severe: slope	Moderate: slope	Moderate: depth to bedrock; slope.	Severe: depth to bedrock.	Slight.

TABLE 8.—*Limitations of the soils*

Soils	Estimated degree and kind of limitations for—				
	Septic tank absorption fields	Sewage lagoons	Sites for buildings with basements	Shallow excavations	Campsites (tents and small trailers)
Johnsburg silt loam	Severe: very slow permeability; seasonal high water table.	Slight	Severe: seasonal high water table.	Severe: somewhat poorly drained.	Severe: seasonal high water table.
Karnak silty clay	Severe: slow permeability; seasonal high water table; flooding.	Severe: flooding	Severe: seasonal high water table; flooding.	Severe: poorly drained; flooding.	Severe: seasonal high water table; flooding.
Lawrence silt loam	Severe: slow permeability; seasonal high water table.	Slight	Severe: seasonal high water table.	Severe: somewhat poorly drained.	Severe: seasonal high water table.
Lindside silt loam	Severe: seasonal high water table; flooding.	Severe: flooding	Severe: seasonal high water table; flooding.	Severe: flooding	Moderate: no flooding during season of use.
Linker loam, 2 to 6 percent slopes.	Severe: depth to bedrock.	Severe: moderately rapid permeability; depth to bedrock.	Severe: depth to bedrock.	Severe: depth to bedrock.	Slight
Linker loam, 6 to 12 percent slopes.	Severe: depth to bedrock.	Severe: moderately rapid permeability; depth to bedrock; slope.	Severe: depth to bedrock.	Severe: depth to bedrock.	Moderate: slope
Melvin silt loam	Severe: seasonal high water table; flooding.	Severe: flooding	Severe: seasonal high water table; flooding.	Severe: poorly drained; flooding.	Severe: seasonal high water table; flooding.
Newark silt loam	Severe: seasonal high water table; flooding.	Severe: flooding	Severe: seasonal high water table; flooding.	Severe: somewhat poorly drained; flooding.	Severe: seasonal high water table; flooding.
Nicholson silt loam, 0 to 2 percent slopes.	Moderate: seasonal high water table; slow permeability.	Slight	Severe: seasonal high water table.	Moderate: silty clay loam texture; moderately well drained.	Moderate: slow permeability.
Nicholson silt loam, 2 to 6 percent slopes.	Severe: seasonal high water table; slow permeability.	Moderate: slope	Severe: seasonal high water table.	Moderate: silty clay loam texture; moderately well drained.	Moderate: slow permeability.
Nicholson silt loam, 6 to 12 percent slopes.	Severe: seasonal high water table; slow permeability.	Severe: slope	Severe: seasonal high water table.	Moderate: silty clay loam texture; moderately well drained; slope.	Moderate: slow permeability; slope.
Nolin silt loam	Severe: flooding	Severe: flooding	Severe: flooding	Severe: flooding	Moderate: no flooding during season of use.
Pembroke silt loam, 0 to 2 percent slopes.	Slight	Moderate: moderate permeability.	Moderate: moderate shrink-swell potential.	Moderate: silty clay loam texture.	Slight

See footnote at end of table.

for town and country planning—Continued

Estimated degree and kind of limitations for—Continued					
Local roads and streets	Athletic fields	Play and picnic areas	Lawns and landscaping	Sanitary landfills [1] (trench method)	Paths and trails
Severe: seasonal high water table.	Severe: seasonal high water table; very slow permeability.	Moderate: seasonal high water table.	Moderate: seasonal high water table.	Severe: seasonal high water table.	Moderate: seasonal high water table.
Severe: seasonal high water table; poor traffic-supporting capacity.	Severe: seasonal high water table; flooding.	Severe: seasonal high water table; flooding.	Severe: seasonal high water table; silty clay texture; flooding.	Severe: seasonal high water table; silty clay texture; flooding.	Severe: seasonal high water table; flooding.
Severe: seasonal high water table.	Severe: seasonal high water table; slow permeability.	Moderate: seasonal high water table.	Moderate: seasonal high water table.	Severe: seasonal high water table.	Moderate: seasonal high water table.
Severe: flooding	Severe: flooding	Moderate: flooding	Severe: flooding	Severe: seasonal high water table; flooding.	Slight.
Moderate: depth to bedrock; poor traffic-supporting capacity.	Moderate: depth to bedrock; slope.	Slight	Moderate: depth to bedrock.	Severe: depth to bedrock.	Slight.
Moderate: depth to bedrock; poor traffic-supporting capacity; slope.	Severe: slope	Moderate: slope	Moderate: depth to bedrock; slope.	Severe: depth to bedrock.	Slight.
Severe: seasonal high water table; flooding.	Severe: seasonal high water table; flooding.	Severe: seasonal high water table; flooding.	Severe: seasonal high water table; flooding.	Severe: seasonal high water table; flooding.	Severe: seasonal high water tabl flooding.
Severe: seasonal high water table; flooding.	Severe: seasonal high water table; flooding.	Moderate: seasonal high water table; flooding.	Severe: seasonal high water table; flooding.	Severe: seasonal high water table; flooding.	Moderate: seasonal high wat table; flooding.
Moderate: seasonal high water table; poor traffic-supporting capacity.	Moderate: seasonal high water table; slow permeability.	Slight	Slight	Moderate: moderately well drained.	Slight.
Moderate: seasonal high water table; poor traffic-supporting capacity.	Moderate: slow permeability; slope.	Slight	Slight	Moderate: moderately well drained.	Slight.
Moderate: seasonal high water table; poor traffic-supporting capacity; slope.	Severe: slow permeability; slope.	Moderate: slope	Moderate: slope	Moderate: moderately well drained.	Slight.
Severe: flooding	Severe: flooding	Moderate: flooding	Severe: flooding	Severe: flooding	Slight.
Moderate: poor traffic-supporting capacity.	Slight	Slight	Slight	Moderate: silty clay loam texture.	Slight.

TABLE 8.—*Limitations of the*

Soils	Estimated degree and kind of limitations for—				
	Septic tank absorption fields	Sewage lagoons	Sites for buildings with basements	Shallow excavations	Campsites (tents and small trailers)
Pembroke silt loam, 2 to 6 percent slopes.	Slight	Moderate: moderate permeability; slope.	Moderate: moderate shrink-swell potential.	Moderate: silty clay loam texture.	Slight
Pembroke silt loam, 6 to 12 percent slopes.	Moderate: slope	Severe: slope	Moderate: moderate shrink-swell potential; slope.	Moderate: silty clay loam texture; slope.	Moderate: slope
Pembroke silty clay loam, 6 to 12 percent slopes, severely eroded.	Moderate: slope	Severe: slope	Moderate: moderate shrink-swell potential; slope.	Moderate: silty clay loam texture; slope.	Moderate: silty clay loam surface layer; slope.
Pickwick silt loam, 2 to 6 percent slopes.	Slight	Moderate: moderate permeability; slope.	Slight	Moderate: clay loam texture.	Slight
Pickwick silt loam, 6 to 12 percent slopes.	Moderate: slope	Severe: slope	Moderate: slope	Moderate: clay loam texture; slope.	Moderate: slope
Pickwick silty clay loam, 6 to 12 percent slopes, severely eroded.	Moderate: slope	Severe: slope	Moderate: slope	Moderate: clay loam texture; slope.	Moderate: silty clay loam surface layer; slope.
Robertsville silt loam.	Severe: seasonal high water table; very slow permeability.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: poorly drained.	Severe: seasonal high water table; very slow permeability.
Rock outcrop-Fredonia-Colbert complex.	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope
Sadler silt loam, 0 to 2 percent slopes.	Severe: slow permeability; seasonal high water table.	Slight	Severe: seasonal high water table.	Moderate: silty clay loam texture; moderately well drained.	Moderate: slow permeability.
Sadler silt loam, 2 to 6 percent slopes.	Severe: slow permeability; seasonal high water table.	Moderate: slope	Severe: seasonal high water table.	Moderate: silty clay loam texture; moderately well drained.	Moderate: slow permeability.
Steff silt loam	Severe: seasonal high water table; flooding.	Severe: flooding	Severe: seasonal high water table; flooding.	Severe: flooding	Severe: flooding
Talbott silt loam, 2 to 6 percent slopes.	Severe: moderately slow permeability.	Moderate: depth to bedrock; slope.	Moderate: moderate shrink-swell potential; depth to bedrock.	Severe: clay texture.	Slight
Talbott silt loam, 6 to 12 percent slopes.	Severe: moderately slow permeability.	Severe: slope	Moderate: moderate shrink-swell potential; depth to bedrock; slope.	Severe: clay texture.	Moderate: slope
Talbott silt loam, 12 to 20 percent slopes.	Severe: moderately slow permeability; depth to bedrock.	Severe: depth to bedrock; slope.	Severe: depth to bedrock; slope.	Severe: depth to bedrock; clay texture; slope.	Severe: slope

See footnote at end of table.

for town and country planning—Continued

Estimated degree and kind of limitations for—Continued					
Local roads and streets	Athletic fields	Play and picnic areas	Lawns and landscaping	Sanitary landfills [1] (trench method)	Paths and trails
Moderate: poor traffic-supporting capacity.	Moderate: slope	Slight	Slight	Moderate: silty clay loam texture.	Slight.
Moderate: poor traffic-supporting capacity; slope.	Severe: slope	Moderate: slope	Moderate: slope	Moderate: silty clay loam texture.	Slight.
Moderate: poor traffic-supporting capacity; slope.	Severe: slope	Moderate: silty clay loam surface layer; slope.	Severe: slope; severe erosion.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Moderate: poor traffic-supporting capacity.	Moderate: slope	Slight	Slight	Moderate: clay loam texture.	Slight.
Moderate: poor traffic-supporting capacity; slope.	Severe: slope	Moderate: slope	Moderate: slope	Moderate: clay loam texture.	Slight.
Moderate: poor traffic-supporting capacity; slope.	Severe: slope	Moderate: silty clay loam surface layer.	Moderate: slope; severe erosion.	Moderate: clay loam texture.	Moderate: silty clay loam surface layer.
Severe: seasonal high water table.	Severe: seasonal high water table; very slow permeability.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table; poorly drained.	Severe: seasonal high water table; poorly drained.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Moderate: seasonal high water table; poor traffic-supporting capacity.	Moderate: slow permeability; seasonal high water table.	Slight	Slight	Moderate: moderately well drained.	Slight.
Moderate: seasonal high water table; poor traffic-supporting capacity.	Moderate: slow permeability; seasonal high water table.	Slight	Slight	Moderate: moderately well drained.	Slight.
Severe: flooding	Severe: flooding	Moderate: flooding.	Severe: flooding	Severe: flooding	Slight.
Severe: poor traffic-supporting capacity.	Moderate: moderately slow permeability; slope.	Slight	Slight	Severe: depth to bedrock; clay texture.	Slight.
Severe: poor traffic-supporting capacity.	Severe: slope	Moderate: slope	Moderate: slope	Severe: depth to bedrock; clay texture.	Slight.
Severe: poor traffic-supporting capacity; slope.	Severe: slope	Severe: slope	Severe: slope	Severe: depth to bedrock; clay texture.	Moderate: slope.

TABLE 8.—*Limitations of the soils*

Soils	Estimated degree and kind of limitations for—				
	Septic tank absorption fields	Sewage lagoons	Sites for buildings with basements	Shallow excavations	Campsites (tents and small trailers)
Talbott silty clay, 6 to 20 percent slopes, severely eroded.	Severe: moderately slow permeability; depth to bedrock.	Severe: depth to bedrock; slope.	Severe: depth to bedrock; slope.	Severe: depth to bedrock; clay texture; slope.	Severe: silty clay surface layer; slope.
Talbott-Colbert rocky silt loams, 2 to 20 percent slopes.	Severe: moderately slow permeability; depth to bedrock; slope.	Severe: depth to bedrock; slope.	Severe: depth to bedrock; slope.	Severe: depth to bedrock; clay texture.	Moderate to severe: severe where slopes are more than 12 percent; moderately slow permeability; rockiness.
Talbott-Colbert rocky silt loams, 20 to 50 percent slopes.	Severe: moderately slow permeability; depth to bedrock.	Severe: depth to bedrock; slope.	Severe: depth to bedrock; slope.	Severe: depth to bedrock; clay texture; slope.	Severe: moderately slow permeability; rockiness; slope.
Wellston silt loam, 2 to 6 percent slopes.	Moderate: depth to bedrock.	Moderate: moderate permeability; slope.	Moderate: depth to bedrock.	Moderate: depth to bedrock.	Slight.
Wellston silt loam, 6 to 12 percent slopes.	Moderate: depth to bedrock; slope.	Severe: slope.	Moderate: depth to bedrock; slope.	Moderate: depth to bedrock; slope.	Moderate: slope.
Zanesville silt loam, 2 to 6 percent slopes.	Severe: seasonal high water table; slow permeability.	Moderate: slope.	Moderate: seasonal high water table.	Moderate: silty clay loam texture.	Moderate: seasonal high water table; slow permeability.
Zanesville silt loam, 6 to 12 percent slopes.	Severe: seasonal high water table; slow permeability.	Severe: slope.	Moderate: seasonal high water table; slope.	Moderate: silty clay loam texture; slope.	Moderate: seasonal high water table; slow permeability; slope.

[1] Onsite study is needed of the underlying strata, water table, and hazard of aquifer pollution and drainage into ground water for landfills deeper than 5 or 6 feet.

for town and country planning—Continued

Estimated degree and kind of limitations for—Continued					
Local roads and streets	Athletic fields	Play and picnic areas	Lawns and landscaping	Sanitary landfills [1] (trench method)	Paths and trails
Severe: poor traffic-supporting capacity; slope.	Severe: silty clay surface layer; slope.	Severe: silty clay surface layer; slope.	Severe: severe erosion; slope.	Severe: depth to bedrock; clay texture.	Moderate: silty clay surface layer; slope.
Severe: poor traffic-supporting capacity; slope; rockiness.	Severe: slope; rockiness.	Moderate to severe: severe where slopes are more than 12 percent.	Moderate to severe: severe where slopes are more than 12 percent; rockiness.	Severe: depth to bedrock; clay texture.	Slight.
Severe: poor traffic-supporting capacity; slope; rockiness.	Severe: slope; rockiness.	Severe: slope	Severe: slope	Severe: depth to bedrock; clay texture; slope.	Severe: slope.
Moderate: poor traffic-supporting capacity.	Moderate: slope	Slight	Slight	Severe: depth to bedrock.	Slight.
Moderate: poor traffic-supporting capacity; slope.	Severe: slope	Moderate: slope	Moderate: slope	Severe: depth to bedrock.	Slight.
Moderate: seasonal high water table; poor traffic-supporting capacity.	Moderate: slow permeability; slope.	Slight	Slight	Moderate: silty clay loam texture.	Slight.
Moderate: seasonal high water table; poor traffic-supporting capacity; slope.	Severe: slow permeability; slope.	Moderate: slope	Moderate: slope	Severe: depth to bedrock.	Slight.

lationship to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation (*6*). First through classification, and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

The narrow categories of classification, such as those used in detailed soil surveys, allow us to organize and apply knowledge about soils in managing farms, fields, and woodlands; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas such as countries and continents.

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Because this system is under continual study,[5] readers interested in developments of the current system should search the latest literature available (*14*, *16*).

The current system of classification has six categories. Beginning with the broadest, these categories are the order, the suborder, the great group, the subgroup, the family, and the series. The criteria used as a basis for classification are soil properties that are observable and measurable, and the properties are chosen so that the soils of similar genesis are grouped together. In table 9, the soil series of Logan County are placed in three categories of the current system. Classes of the current system are briefly defined in the following paragraphs.

[5] See the unpublished working document, "Selected Chapters from the Unedited Text of the Soil Taxonomy" available in the SCS State Office, Lexington, Ky.

ORDER.—Ten soil orders are recognized. The properties used to differentiate among soil orders are those that tend to give broad climatic groupings of soils. The two exceptions to this are Entisols and Histosols, which occur in many different climates. Each order is named with a word of three or four syllables ending in *sol* (Ent-i-sol). The orders represented in Logan County are Entisols, Inceptisols, Mollisols, Alfisols, and Ultisols.

SUBORDER.—Each order is divided into suborders, based primarily on those soil characteristics that seem to produce classes that have the greatest genetic similarity, The suborders narrow the broad climatic range permitted in the order. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of waterlogging, or soil differences that result from climate or vegetation.

GREAT GROUP.—Each suborder is divided into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus has accumulated; those that have a pan that interferes with growth of roots, movement of water, or both; and thick, dark-colored surface horizons. The features used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), dark-red and dark-brown colors associated with basic

TABLE 9.—*Classification of soil series by higher categories*

Series	Family	Subgroup	Order
Allegheny	Fine-loamy, mixed, mesic	Typic Hapludults	Ultisols.
Baxter	Clayey, mixed, mesic	Typic Paleudults	Ultisols.
Bonnie	Fine-silty, mixed, acid, mesic	Typic Fluvaquents	Entisols.
Clifty	Fine-loamy, mixed, mesic	Fluventic Dystrochrepts	Inceptisols.
Colbert	Very fine, montmorillonitic, thermic	Vertic Hapludalfs	Alfisols.
Crider	Fine-silty, mixed, mesic	Typic Paleudalfs	Alfisols.
Cuba	Fine-silty, mixed, mesic	Fluventic Dystrochrepts	Inceptisols.
Cumberland	Fine, mixed, thermic	Rhodic Paleudalfs	Alfisols.
Dunning	Fine, mixed, mesic	Fluvaquentic Haplaquolls	Mollisols.
Elk	Fine-silty, mixed, mesic	Ultic Hapludalfs	Alfisols.
Epley	Fine-silty over clayey, mixed, mesic	Glossic Hapludalfs	Alfisols.
Fredonia	Fine, mixed, mesic	Typic Hapludalfs	Alfisols.
Frondorf	Fine-loamy, mixed, mesic	Ultic Hapludalfs	Alfisols.
Hartsells	Fine-loamy, siliceous, thermic	Typic Hapludults	Ultisols.
Johnsburg	Fine-silty, mixed, mesic	Aquic Fragiudults	Ultisols.
Karnak	Fine, montmorillonitic, nonacid, mesic	Vertic Haplaquepts	Inceptisols.
Lawrence	Fine-silty, mixed, mesic	Aquic Fragiudalfs	Alfisols.
Lindside	Fine-silty, mixed, mesic	Fluvaquentic Eutrochrepts	Inceptisols.
Linker [1]	Fine-loamy, siliceous, thermic	Typic Hapludults	Ultisols.
Melvin	Fine-silty, mixed, nonacid, mesic	Typic Fluvaquents	Entisols.
Newark	Fine-silty, mixed, nonacid, mesic	Aeric Fluvaquents	Entisols.
Nicholson	Fine-silty, mixed, mesic	Typic Fragiudalfs	Alfisols.
Nolin	Fine-silty, mixed, mesic	Dystric Fluventic Eutrochrepts	Inceptisols.
Pembroke	Fine-silty, mixed, mesic	Mollic Paleudalfs	Alfisols.
Pickwick	Fine-silty, mixed, thermic	Typic Hapludults	Ultisols.
Robertsville	Fine-silty, mixed, mesic	Typic Fragiaqualfs	Alfisols.
Sadler	Fine-silty, mixed, mesic	Glossic Fragiudalfs	Alfisols.
Steff	Fine-silty, mixed, mesic	Fluvaquentic Dystrochrepts	Inceptisols.
Talbott	Fine, mixed, thermic	Typic Hapludalfs	Alfisols.
Wellston	Fine-silty, mixed, mesic	Ultic Hapludalfs	Alfisols.
Zanesville	Fine-silty, mixed, mesic	Typic Fragiudalfs	Alfisols.

[1] The Linker soils in this county are taxadjuncts to the series because they have a thicker solum and are deeper over bedrock than is defined in the range for the series.

rocks, and the like. The names of great groups are made by adding a prefix to the name of the suborder.

SUBGROUP.—Each great group is divided into subgroups, one that represents the central, or typic, segments of the group and others, called intergrades, that have properties of the group and also one or more properties of another great group, suborder, or order. Subgroups can also be made in those instances where soil properties intergrade outside the range of any other great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives in front of the name of the great group.

FAMILY.—Soil families are established within a subgroup primarily on the basis of properties important to the growth of plants or on the behavior of soils if used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence. The family name consists of a series of adjectives preceding the subgroup name.

SERIES.—The series is a group of soils that have major horizons that, except for texture of the surface layer, are similar in important characteristics and in arrangement in the profile. The soil series in Logan County are described in the section "Descriptions of the Soils."

General Nature of the County

This section provides general information about Logan County. It briefly describes the physiography, geology, relief, and drainage; farming; and climate of the county.

Logan County was formed in 1792, the same year Kentucky became a State (*7*). It was the 13th of the 120 counties in the State. It is presently the third largest county in Kentucky and has a land area of 360,130 acres.

Russellville, the county seat, is located about in the center of the county. It is currently the largest town in the county, and most of the industry located in the county is in or near Russellville.

Physiography, Geology, Relief, and Drainage

The physiographic areas of Logan County are the Western Coal Fields and the Western Pennyroyal. The Western Coal Fields is in the northern part of the county, and the Pennyroyal lies to the south. The rock formations of the Coal Fields are of Pennsylvanian age; the formations of the Pennyroyal are of Mississippian age. The Pennsylvania Formations are sandstone and shale. The Mississippian Formations are mainly limestone, but in places they are interbedded limestone, sandstone, and shale.

The topography of the county ranges from nearly level to steep. In general, the steeper soils are within the Mud River Watershed in the northwest part of the county.

Surface drainage from approximately 55 percent of the county flows northward. The Mud River and Muddy Creek Watersheds flow northward to their confluence with Green River. Gasper River and its tributaries flow northward to Barren River, which also empties into Green River. Surface drainage from the rest of the county empties into Red River in the southern part of the county.

Farming

Farming is a major source of income in Logan County. In 1969, about 84 percent of the county was in farms. The average size of farms has steadily increased the last several years. In 1954, the average size was approximately 113 acres; in 1964 it was 141 acres; and in 1969, 155 acres.

The major source of farm income is the sale of tobacco, livestock, and livestock products. Three types of tobacco are grown: burley, dark air cured, and dark fired. The acreage of tobacco has decreased during the last several years, but production per acre has steadily increased. Major livestock enterprises are the raising of dairy cattle, beef cattle, and hogs.

The chief grain crops are corn, wheat, and soybeans. Large acreages of pasture and hay are used by livestock. Tall fescue, orchardgrass, and legumes are the main pasture plants. Red clover, alfalfa, annual lespedezas, and grasses are used mostly for hay.

Climate [6]

This summary was prepared from data recorded at Russellville during the period 1931 to 1960 and is representative of this general area of Kentucky.

The climate of Logan County is temperate and is favorable for many kinds of plants and animals. Summers are warm and humid, and winters are moderately cold and fairly short. Precipitation is fairly well distributed throughout the year. Table 10 shows data on temperature and precipitation; table 11 shows the probabilities of freezing temperatures after specific dates in spring and before specific dates in fall.

The average annual rainfall is 48.2 inches. The average annual snowfall, based on sparse data, is approximately 18 inches. About 9 days each year have a snowfall of 1 inch or more.

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[6] By ALLEN B. ELAM, JR., climatologist for Kentucky, National Weather Service, U.S. Department of Commerce.

TABLE 10.—*Temperature and precipitation data*

[Data recorded at Russellville, Logan County, Kentucky, for period 1931 to 1960]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Average maximum	Average minimum	Average total	One year in 10 will have: Less than—	One year in 10 will have: More than—	Days that have 1 inch or more of snow on ground	Average depth of snow on days that have snow cover [1]
	°F	°F	°F	°F	Inches	Inches	Inches	Number	Inches
January	46	28	68	8	5. 5	1. 7	10. 0	3	2
February	49	29	70	9	4. 3	1. 3	8. 0	2	3
March	58	35	77	18	5. 1	2. 5	8. 0	1	4
April	70	45	86	29	4. 0	2. 2	6. 2	0	----------
May	79	54	91	39	3. 8	1. 5	7. 1	0	----------
June	88	63	97	48	3. 9	1. 0	8. 4	0	----------
July	91	66	99	55	4. 3	2. 0	7. 1	0	----------
August	90	65	99	52	3. 5	1. 0	6. 8	0	----------
September	84	57	96	41	3. 4	1. 0	6. 6	0	----------
October	73	46	87	29	2. 3	1. 0	4. 0	0	----------
November	57	35	77	17	3. 9	1. 4	7. 3	1	1
December	48	29	66	11	4. 2	1. 7	6. 6	2	2
Year	69	46	[2] 101	[3] 2	48. 2	37. 8	58. 1	9	2

[1] Rough estimates, based on sparse data.
[2] Average annual highest temperature.
[3] Average annual lowest temperature.

TABLE 11.—*Probabilities of last freezing temperature in spring and first in fall*

[All data recorded at Russellville, Logan County, Kentucky, for the period 1931 to 1960]

Probability	Dates for given probability and temperature [1]				
	16° F or lower	20° F or lower	24° F or lower	28° F or lower	32° F or lower
Spring:					
1 year in 10 later than	March 19	March 23	April 5	April 18	April 28
2 years in 10 later than	March 11	March 16	March 30	April 12	April 23
5 years in 10 later than	February 25	March 4	March 18	April 1	April 13
Fall:					
1 year in 10 earlier than	November 22	November 14	October 30	October 17	October 6
2 years in 10 earlier than	November 27	November 20	November 5	October 23	October 11
5 years in 10 earlier than	December 7	November 30	November 15	November 1	October 21

[1] All data are based on temperatures in a standard U.S. Weather Service thermometer shelter at a height of approximately 5 feet above the ground in a representative exposure. At times temperatures are lower nearer the ground or in local areas that are subject to extreme air drainage.

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Glossary

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Base saturation. The degree to which material that has base-exchange properties is saturated with exchangeable cations other than hydrogen, expressed as a percentage of the cation-exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Chert. Angular fragments less than 3 inches in diameter.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Depth, soil. In this survey it refers to the depth of the soil over bedrock. Depth classes used in this survey are deep, more than 40 inches; moderately deep, 20 to 40 inches; and shallow, less than 20 inches.

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Fragipan. A loamy, brittle, subsurface horizon that is very low in organic-matter content and clay but is rich in silt or very fine sand. The layer is seemingly cemented. When dry, it is hard or very hard and has a high bulk density in comparison with the horizon or horizons above it. When moist, the fragipan tends to rupture suddenly if pressure is applied, rather than to deform slowly. The layer is generally mottled, is slowly or very slowly permeable to water, and has few or many bleached fracture planes that form polygons. Fragipans are a few inches to several feet thick; they generally occur below the B horizon, 15 to 40 inches below the surface.

Gravel. Rounded or angular rock fragments that are not prominently flattened and are up to 3 inches in diameter.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon, but may be immediately beneath an A or B horizon.

Karst topography. A limestone region marked by sinkholes, abrupt ridges, rock outcrops, caverns, and underground streams.

Loess. Fine-grained material, dominantly of silt-sized particles, that has been deposited by wind.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An

acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Mildly alkaline	7.4 to 7.8
Very strongly acid	4.5 to 5.0	Moderately alkaline	7.9 to 8.4
Strongly acid	5.1 to 5.5	Strongly alkaline	8.5 to 9.0
Medium acid	4.6 to 6.0	Very strongly alkaline	9.1 and higher
Slightly acid	6.1 to 6.5		
Neutral	6.6 to 7.3		

Root zone. The part of the soil that is penetrated, or can be penetrated, by plant roots. Depth classes used in this survey are deep, more than 40 inches; moderately deep, 20 to 40 inches; and shallow, less than 20 inches.

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Slope, soil. Slope classes used in this survey are nearly level, 0 to 2 percent; gently sloping, 2 to 6 percent; sloping, 6 to 12 percent; strongly sloping, 12 to 20 percent; moderately steep, 20 to 30 percent; and steep, 30 to 50 percent.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically, the part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Upland (geology). Land consisting of material unworked by water in recent geologic time and lying, in general, at a higher elevation than the alluvial plain or stream terrace. Land above the lowlands along rivers.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

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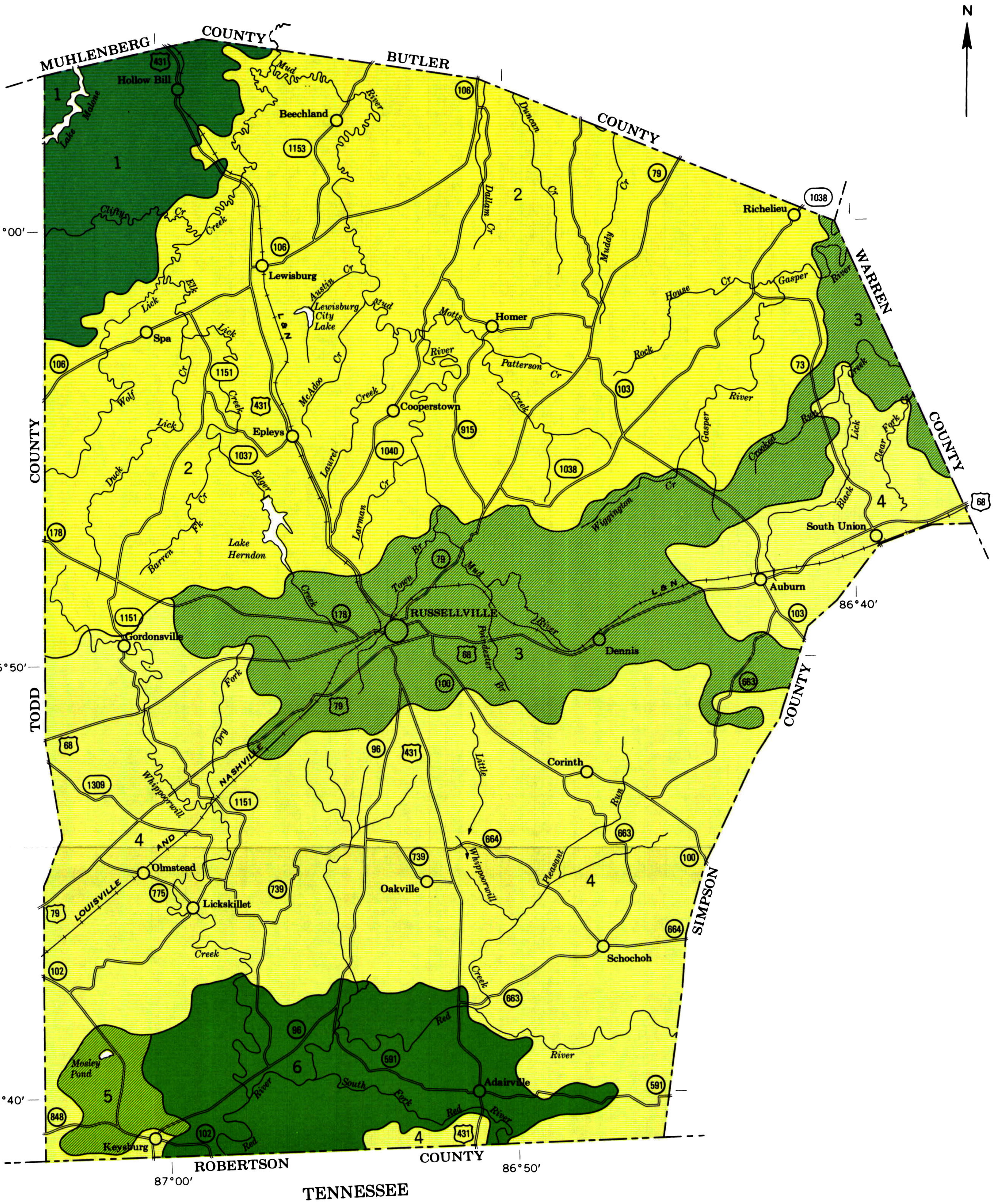

SOIL ASSOCIATIONS

1 Frondorf association: Strongly sloping to steep, moderately deep, well-drained soils that are loamy throughout; on uplands

2 Zanesville-Frondorf-Talbott association: Gently sloping to steep, deep and moderately deep, well drained and moderately well drained soils that have a loamy or clayey subsoil; on uplands

3 Talbott-Fredonia-Rock outcrop association: Gently sloping to steep, moderately deep to deep, well-drained soils that have a clayey subsoil; and rock outcrops; on uplands

4 Pembroke-Crider association: Nearly level to sloping, deep, well-drained soils that have a loamy or clayey subsoil; on uplands

5 Melvin-Robertsville-Nicholson association: Level to gently sloping, deep, poorly drained and moderately well drained soils that have a loamy subsoil; on uplands and flood plains

6 Pembroke-Baxter association: Gently sloping to strongly sloping, deep, well-drained soils that have a clayey subsoil; on uplands

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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
KENTUCKY AGRICULTURAL EXPERIMENT STATION

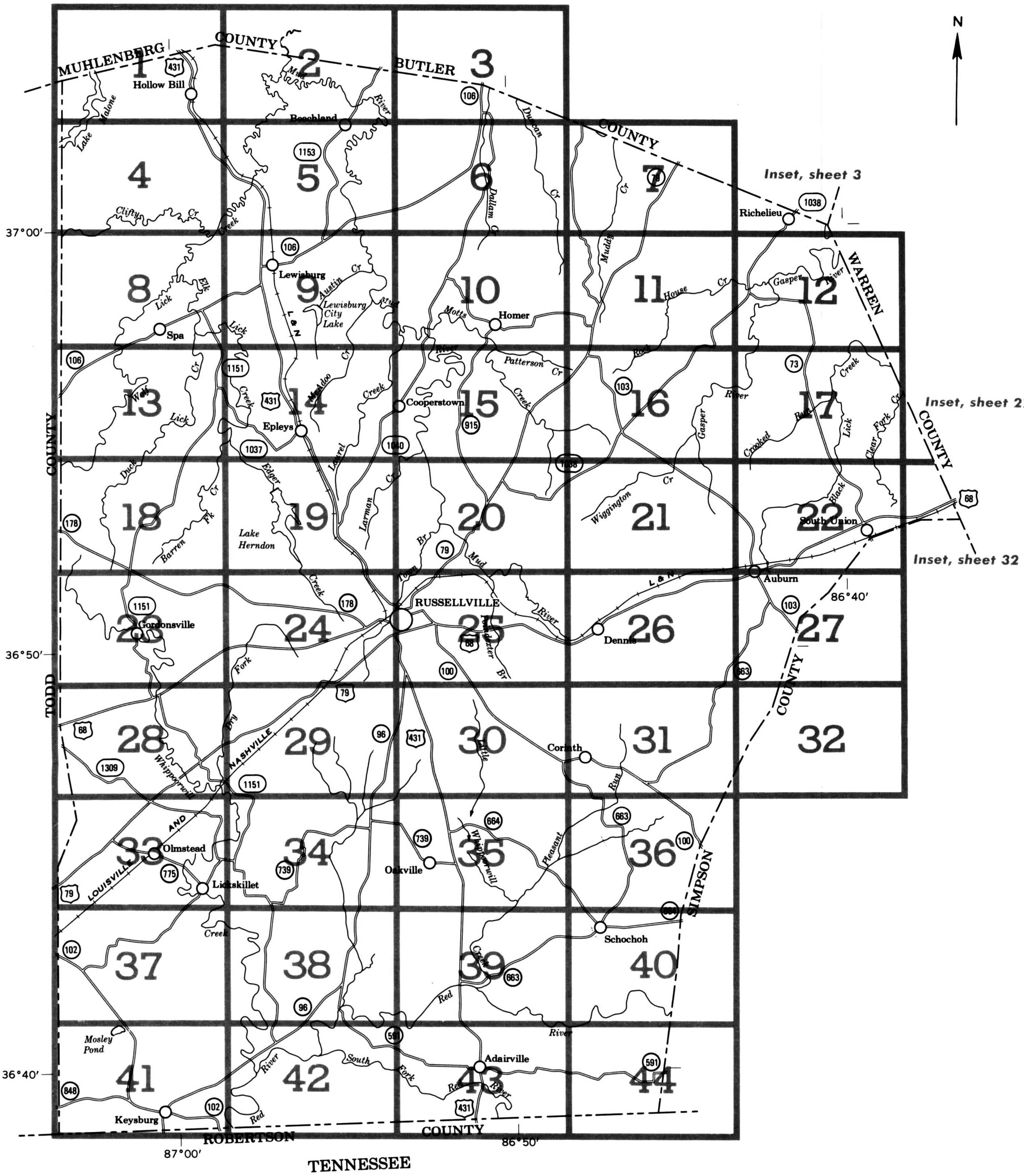
GENERAL SOIL MAP

LOGAN COUNTY, KENTUCKY

Scale 1:190,080

1 0 1 2 3 4 Miles

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



INDEX TO MAP SHEETS

LOGAN COUNTY, KENTUCKY

Scale 1:190,080

1 0 1 2 3 4 Miles

SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, D, E, or F, shows the slope. Most symbols without a slope letter are those of nearly level soils, but some are for land types that have a considerable range of slope. The final number 3 in the symbol indicates that the soil is severely eroded.

SYMBOL	NAME
AlB	Allegheny loam, 2 to 6 percent slopes
AlC	Allegheny loam, 6 to 12 percent slopes
AsD	Allegheny stony loam, 12 to 20 percent slopes
BaC	Baxter cherty silt loam, 6 to 12 percent slopes
BaD	Baxter cherty silt loam, 12 to 20 percent slopes
BbC3	Baxter cherty silty clay loam, 6 to 12 percent slopes, severely eroded
Bo	Bonnie silt loam
Cf	Clifty gravelly silt loam
CoC	Colbert silt loam, 6 to 12 percent slopes
CpC3	Colbert silty clay, 6 to 12 percent slopes, severely eroded
CrA	Crider silt loam, 0 to 2 percent slopes
CrB	Crider silt loam, 2 to 6 percent slopes
CrC	Crider silt loam, 6 to 12 percent slopes
Cu	Cuba silt loam
CvB	Cumberland silt loam, 2 to 6 percent slopes
CvC	Cumberland silt loam, 6 to 12 percent slopes
CwC3	Cumberland silty clay loam, 6 to 12 percent slopes, severely eroded
Du	Dunning silty clay loam
ElA	Elk silt loam, 0 to 2 percent slopes
ElB	Elk silt loam, 2 to 6 percent slopes
ElC	Elk silt loam, 6 to 12 percent slopes
EpB	Epley silt loam, 2 to 6 percent slopes
EpC	Epley silt loam, 6 to 12 percent slopes
FeC	Fredonia rocky silty clay loam, 2 to 12 percent slopes
FrC	Frondorf silt loam, 6 to 12 percent slopes
FrD	Frondorf silt loam, 12 to 20 percent slopes
FsF	Frondorf stony complex, 12 to 50 percent slopes
Gu	Gullied land
HaC	Hartsells loam, 6 to 12 percent slopes
Jo	Johnsburg silt loam
Ka	Karnak silty clay
La	Lawrence silt loam
Ld	Lindside silt loam
LnB	Linker loam, 2 to 6 percent slopes
LnC	Linker loam, 6 to 12 percent slopes
Me	Melvin silt loam
Ne	Newark silt loam
NhA	Nicholson silt loam, 0 to 2 percent slopes
NhB	Nicholson silt loam, 2 to 6 percent slopes
NhC	Nicholson silt loam, 6 to 12 percent slopes
No	Nolin silt loam
PeA	Pembroke silt loam, 0 to 2 percent slopes
PeB	Pembroke silt loam, 2 to 6 percent slopes
PeC	Pembroke silt loam, 6 to 12 percent slopes
PfC3	Pembroke silty clay loam, 6 to 12 percent slopes, severely eroded
PkB	Pickwick silt loam, 2 to 6 percent slopes
PkC	Pickwick silt loam, 6 to 12 percent slopes
PlC3	Pickwick silty clay loam, 6 to 12 percent slopes, severely eroded
Ro	Robertsville silt loam
Rx	Rock outcrop-Fredonia-Colbert complex
SaA	Sadler silt loam, 0 to 2 percent slopes
SaB	Sadler silt loam, 2 to 6 percent slopes
St	Steff silt loam
TaB	Talbott silt loam, 2 to 6 percent slopes
TaC	Talbott silt loam, 6 to 12 percent slopes
TaD	Talbott silt loam, 12 to 20 percent slopes
TbD3	Talbott silty clay, 6 to 20 percent slopes, severely eroded
TcD	Talbott-Colbert rocky silt loams, 2 to 20 percent slopes
TcF	Talbott-Colbert rocky silt loams, 20 to 50 percent slopes
WeB	Wellston silt loam, 2 to 6 percent slopes
WeC	Wellston silt loam, 6 to 12 percent slopes
ZaB	Zanesville silt loam, 2 to 6 percent slopes
ZaC	Zanesville silt loam, 6 to 12 percent slopes

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads
- Divided
- Good motor
- Poor motor
- Trail

Highway markers
- National Interstate
- U. S.
- State or county

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail
- Railroad
- Ferry (FY)
- Ford (FORD)
- Grade
- R. R. over
- R. R. under

Buildings
- School
- Church

Mine and quarry

Gravel pit

Power line

Pipeline

Cemetery

Dams

Levee

Tanks

Well, oil or gas

Forest fire or lookout station

Windmill

Located object

BOUNDARIES

- National or state
- County
- Minor civil division
- Reservation
- Land grant
- Small park, cemetery, airport
- Land survey division corners

DRAINAGE

Streams, double-line
- Perennial
- Intermittent

Streams, single-line
- Perennial
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
  - Unclassified

Canals and ditches

Lakes and ponds
- Perennial (water, w)
- Intermittent (int)

Spring

Marsh or swamp

Wet spot

Drainage end or alluvial fan

RELIEF

Escarpments
- Bedrock
- Other

Short steep slope

Prominent peak

Depressions, unclassified

SOIL SURVEY DATA

- Soil boundary and symbol (Dx)
- Gravel
- Stoniness: Stony; Very stony
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gully

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and that of the soil series to which the mapping unit belongs. An outline of the capability classification of soils is given on page 35; an outline of woodland suitability groups, on page 39. Information about management of soils for crops is given in the mapping units. Other information is given in tables as follows:

Acreage and extent, table 1, page 7.
Estimated yields, table 2, page 37.
Engineering use of soils, tables 5, 6, and 7, pages 48 through 61.
Town and country planning, table 8, page 64.

Map symbol	Mapping unit	Page	Capability unit Symbol	Woodland suitability group Symbol
AlB	Allegheny loam, 2 to 6 percent slopes	7	IIe-4	2o1
AlC	Allegheny loam, 6 to 12 percent slopes	7	IIIe-5	2o1
AsD	Allegheny stony loam, 12 to 20 percent slopes	8	VIs-1	2o1
BaC	Baxter cherty silt loam, 6 to 12 percent slopes	8	IIIe-2	2o1
BaD	Baxter cherty silt loam, 12 to 20 percent slopes	8	IVe-1	2o1
BbC3	Baxter cherty silty clay loam, 6 to 12 percent slopes, severely eroded	9	IVe-6	3o1
Bo	Bonnie silt loam	9	IIIw-1	1w2
Cf	Clifty gravelly silt loam	10	IIs-1	1o1
CoC	Colbert silt loam, 6 to 12 percent slopes	10	IVe-4	3c1
CpC3	Colbert silty clay, 6 to 12 percent slopes, severely eroded	10	VIe-2	4c1
CrA	Crider silt loam, 0 to 2 percent slopes	11	I-3	1o2
CrB	Crider silt loam, 2 to 6 percent slopes	11	IIe-1	1o2
CrC	Crider silt loam, 6 to 12 percent slopes	11	IIIe-1	1o2
Cu	Cuba silt loam	12	I-1	1o1
CvB	Cumberland silt loam, 2 to 6 percent slopes	12	IIe-1	2c1
CvC	Cumberland silt loam, 6 to 12 percent slopes	12	IIIe-1	2c1
CwC3	Cumberland silty clay loam, 6 to 12 percent slopes, severely eroded	12	IVe-5	3c1
Du	Dunning silty clay loam	13	IIIw-3	1w2
ElA	Elk silt loam, 0 to 2 percent slopes	13	I-3	2o1
ElB	Elk silt loam, 2 to 6 percent slopes	14	IIe-1	2o1
ElC	Elk silt loam, 6 to 12 percent slopes	14	IIIe-1	2o1
EpB	Epley silt loam, 2 to 6 percent slopes	14	IIe-2	3w1
EpC	Epley silt loam, 6 to 12 percent slopes	15	IIIe-3	3w1
FeC	Fredonia rocky silty clay loam, 2 to 12 percent slopes	15	VIs-1	3x1
FrC	Frondorf silt loam, 6 to 12 percent slopes	16	IIIe-6	3o1
FrD	Frondorf silt loam, 12 to 20 percent slopes	16	IVe-2	3o1
FsF	Frondorf stony complex, 12 to 50 percent slopes	16	VIIs-1	3x2
Gu	Gullied land	16	VIIe-1	------
HaC	Hartsells loam, 6 to 12 percent slopes	18	IIIe-5	2o1
Jo	Johnsburg silt loam	18	IIIw-2	2w1
Ka	Karnak silty clay	19	IIIw-3	1w2
La	Lawrence silt loam	19	IIIw-2	2w1
Ld	Lindside silt loam	20	I-2	1w1
LnB	Linker loam, 2 to 6 percent slopes	20	IIe-4	2o1
LnC	Linker loam, 6 to 12 percent slopes	21	IIIe-5	2o1
Me	Melvin silt loam	22	IIIw-1	1w2
Ne	Newark silt loam	22	IIw-1	1w1
NhA	Nicholson silt loam, 0 to 2 percent slopes	23	IIw-2	3w1
NhB	Nicholson silt loam, 2 to 6 percent slopes	24	IIe-2	3w1
NhC	Nicholson silt loam, 6 to 12 percent slopes	24	IIIe-3	3w1
No	Nolin silt loam	25	I-1	1o1
PeA	Pembroke silt loam, 0 to 2 percent slopes	25	I-3	1o2
PeB	Pembroke silt loam, 2 to 6 percent slopes	25	IIe-1	1o2
PeC	Pembroke silt loam, 6 to 12 percent slopes	25	IIIe-1	1o2
PfC3	Pembroke silty clay loam, 6 to 12 percent slopes, severely eroded	25	IVe-5	2o1
PkB	Pickwick silt loam, 2 to 6 percent slopes	27	IIe-1	2o1
PkC	Pickwick silt loam, 6 to 12 percent slopes	27	IIIe-1	2o1
PlC3	Pickwick silty clay loam, 6 to 12 percent slopes, severely eroded	27	IVe-5	2o1
Ro	Robertsville silt loam	29	IVw-1	2w1
Rx	Rock outcrop-Fredonia-Colbert complex	29	VIIs-2	4x1
SaA	Sadler silt loam, 0 to 2 percent slopes	30	IIw-2	3w1
SaB	Sadler silt loam, 2 to 6 percent slopes	30	IIe-2	3w1
St	Steff silt loam	30	I-2	1w1
TaB	Talbott silt loam, 2 to 6 percent slopes	31	IIe-5	3c1
TaC	Talbott silt loam, 6 to 12 percent slopes	31	IIIe-7	3c1
TaD	Talbott silt loam, 12 to 20 percent slopes	31	IVe-3	3c1
TbD3	Talbott silty clay, 6 to 20 percent slopes, severely eroded	31	VIe-1	4c1
TcD	Talbott-Colbert rocky silt loams, 2 to 20 percent slopes	32	VIs-1	3x1
TcF	Talbott-Colbert rocky silt loams, 20 to 50 percent slopes	32	VIIs-1	3x2
WeB	Wellston silt loam, 2 to 6 percent slopes	32	IIe-1	2o1
WeC	Wellston silt loam, 6 to 12 percent slopes	33	IIIe-1	2o1
ZaB	Zanesville silt loam, 2 to 6 percent slopes	33	IIe-3	3o1
ZaC	Zanesville silt loam, 6 to 12 percent slopes	33	IIIe-4	3o1

LOGAN COUNTY, KENTUCKY — SHEET NUMBER 1

1

N

Scale 1:20000

1 Mile
5000 Feet

LOGAN COUNTY, KENTUCKY NO. 1

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

LOGAN COUNTY, KENTUCKY — SHEET NUMBER 2

N

Scale 1:20000

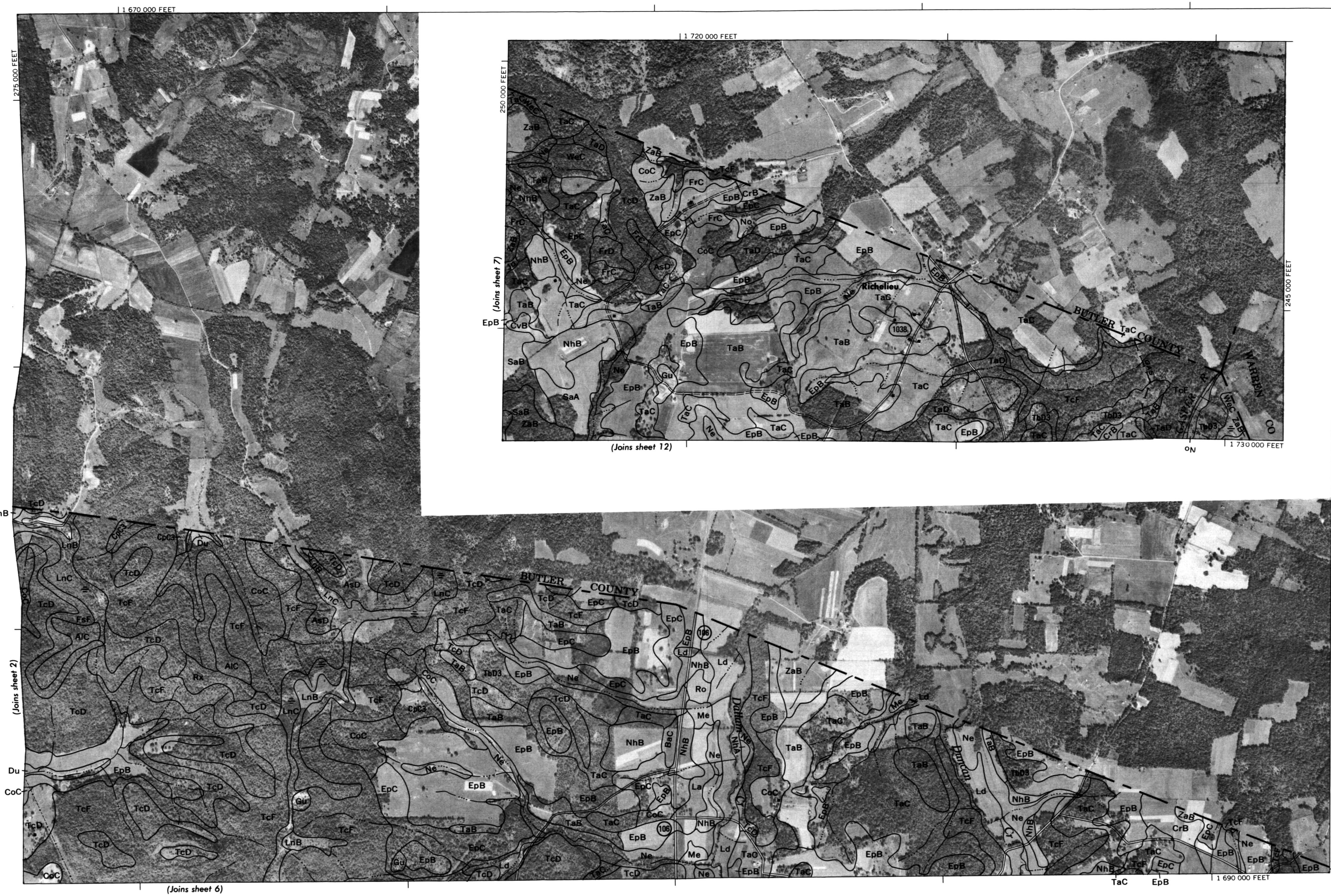
1 Mile — 0 — ¼ — ½ — ¾ — 1

5 000 Feet — 0 — 1000 — 2000 — 3000 — 4000 — 5000

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

3



N

Scale 1:20000

1 Mile
¾
½
¼
0

5000 Feet
4000
3000
2000
1000
0

LOGAN COUNTY, KENTUCKY NO. 3

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

LOGAN COUNTY, KENTUCKY — SHEET NUMBER 4

N

1 Mile
5000 Feet
Scale 1:20000
0 1000 2000 3000 4000 5000
0 ¼ ½ ¾ 1

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

5

LOGAN COUNTY, KENTUCKY NO. 5

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

LOGAN COUNTY, KENTUCKY — SHEET NUMBER 6

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

LOGAN COUNTY, KENTUCKY NO. 7

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station. Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

LOGAN COUNTY, KENTUCKY — SHEET NUMBER 8

N

1 Mile

5 000 Feet

Scale 1:20000

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

LOGAN COUNTY, KENTUCKY NO. 9

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

LOGAN COUNTY, KENTUCKY — SHEET NUMBER 10

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

LOGAN COUNTY, KENTUCKY — SHEET NUMBER 11

(11)

LOGAN COUNTY, KENTUCKY NO. 11

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

12

LOGAN COUNTY, KENTUCKY — SHEET NUMBER 12

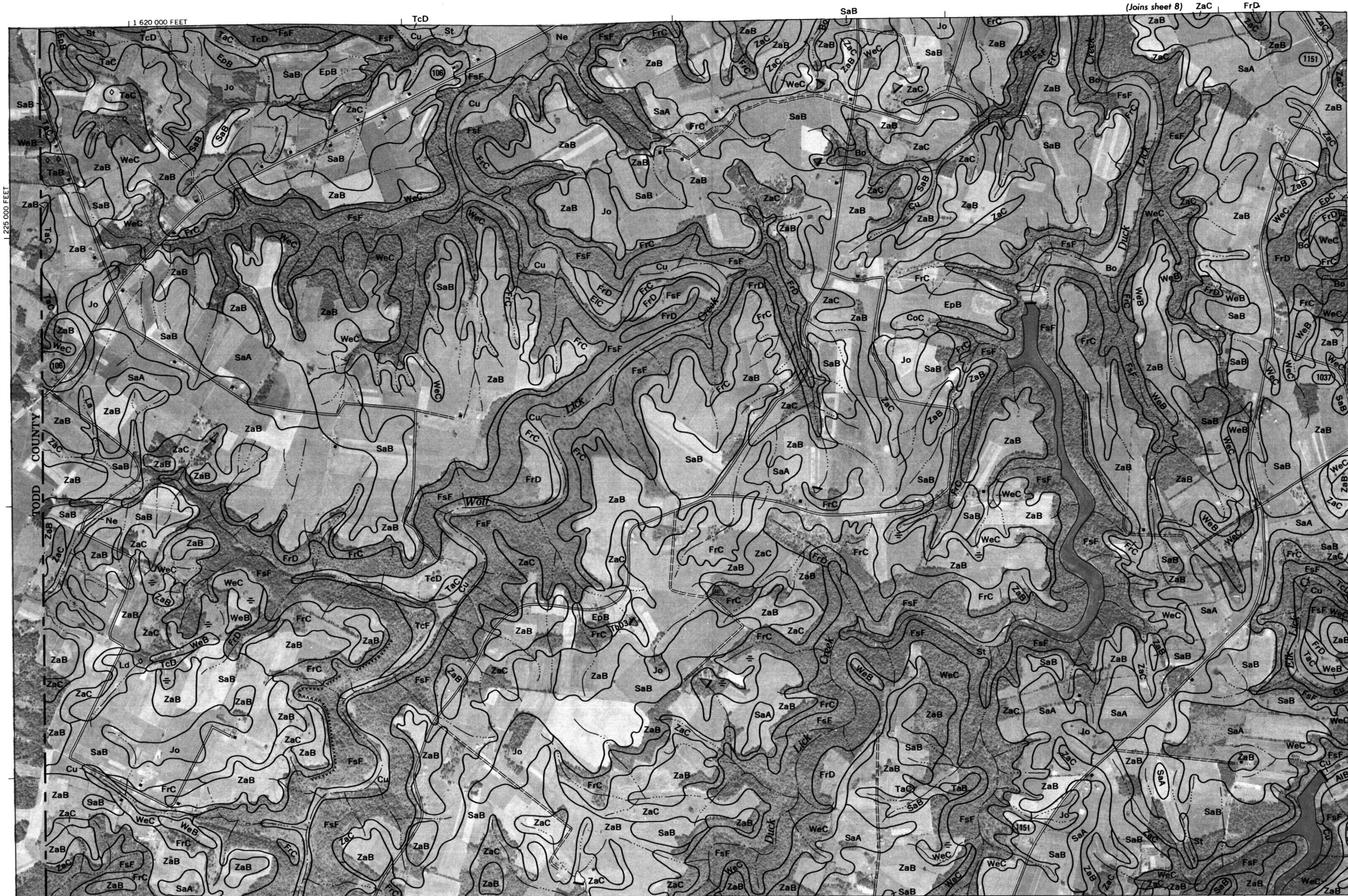
N

Scale 1:20000

1 Mile | 5000 Feet | 0 | 1000 | 2000 | 3000 | 4000 | 5000

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

LOGAN COUNTY, KENTUCKY NO. 12



N

Scale 1:20000

1 Mile ¾ ½ ¼ 0 1

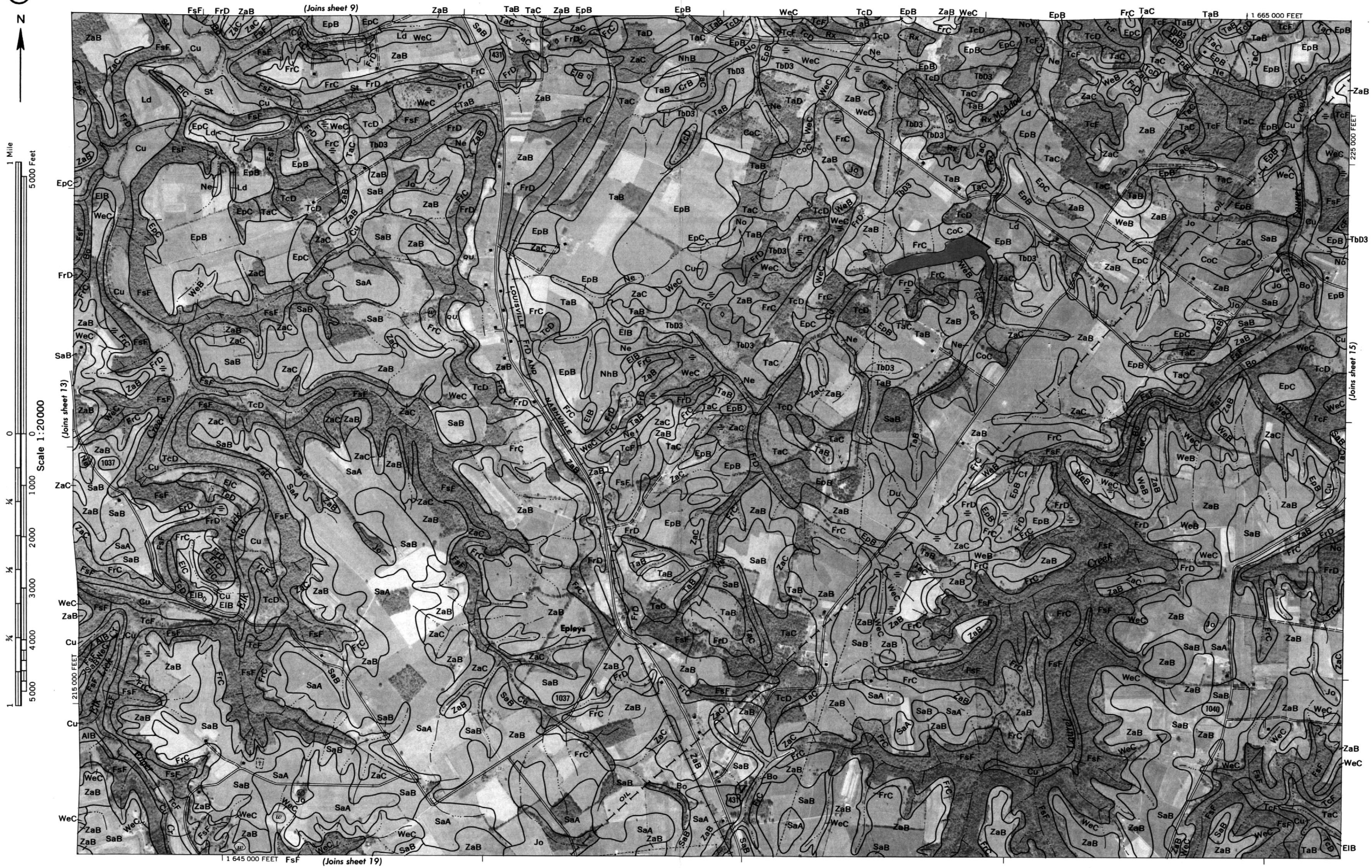
5000 Feet 0 5000

0 1000 2000 3000 4000 5000

LOGAN COUNTY, KENTUCKY NO. 13

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

LOGAN COUNTY, KENTUCKY — SHEET NUMBER 14



Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

LOGAN COUNTY, KENTUCKY — SHEET NUMBER 15

LOGAN COUNTY, KENTUCKY NO. 15

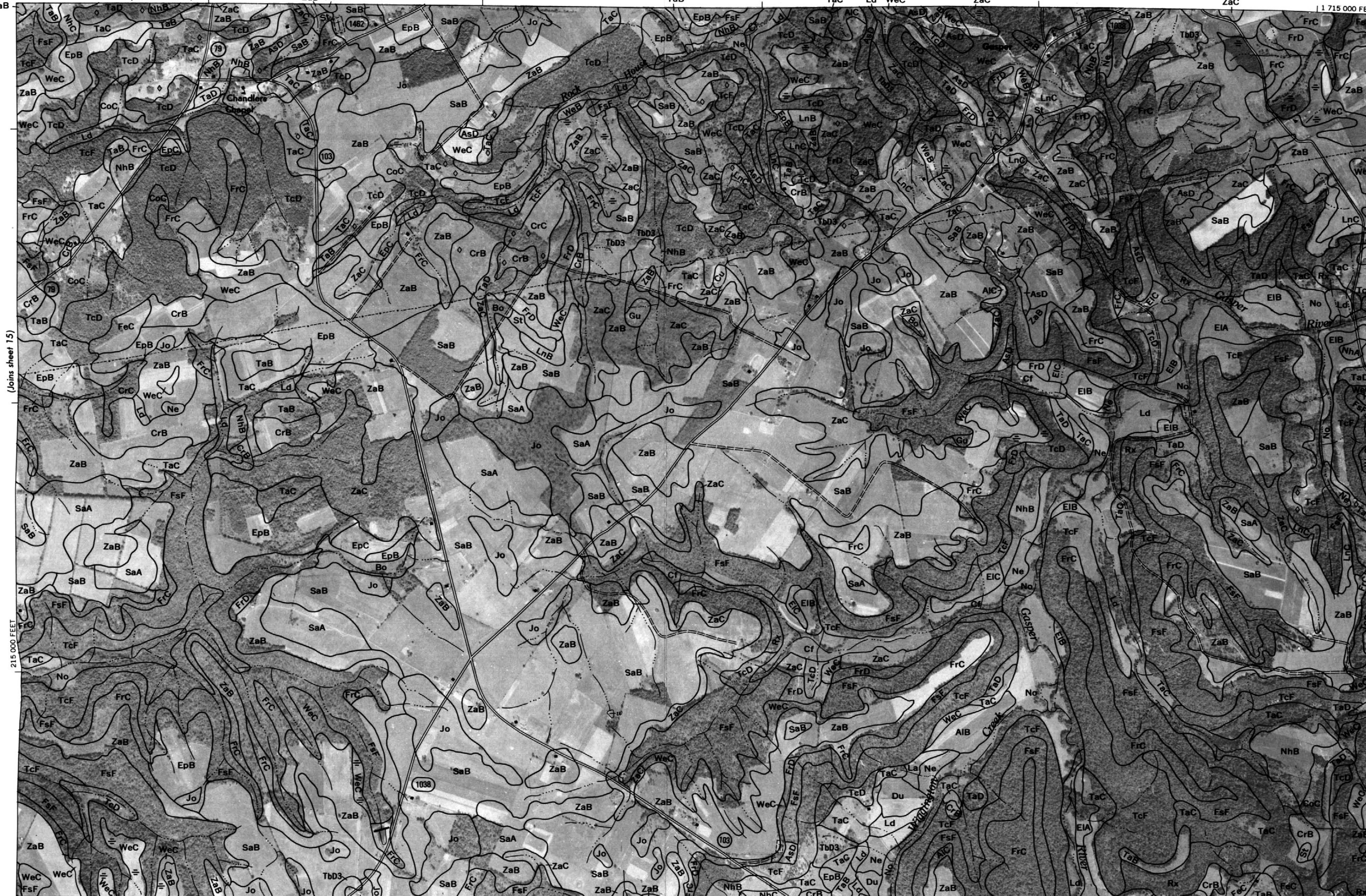
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

(16)

LOGAN COUNTY, KENTUCKY — SHEET NUMBER 16

N

(Joins sheet 11)



(Joins sheet 15)

(Joins sheet 17)

(Joins sheet 21)

1 715 000 FEET

225 000 FEET

215 000 FEET

1 695 000 FEET

1 Mile

5000 Feet

Scale 1:20000

0 1000 2000 3000 4000 5000

1/4 1/2 3/4 1

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

LOGAN COUNTY, KENTUCKY NO. 16

LOGAN COUNTY, KENTUCKY — SHEET NUMBER 17

LOGAN COUNTY, KENTUCKY NO. 17

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

N

Scale 1:20000

1 Mile | 0 | ¼ | ½ | ¾ | 1

5000 Feet | 0 | 1000 | 2000 | 3000 | 4000 | 5000

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

LOGAN COUNTY, KENTUCKY NO. 19

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

LOGAN COUNTY, KENTUCKY — SHEET NUMBER 20

N

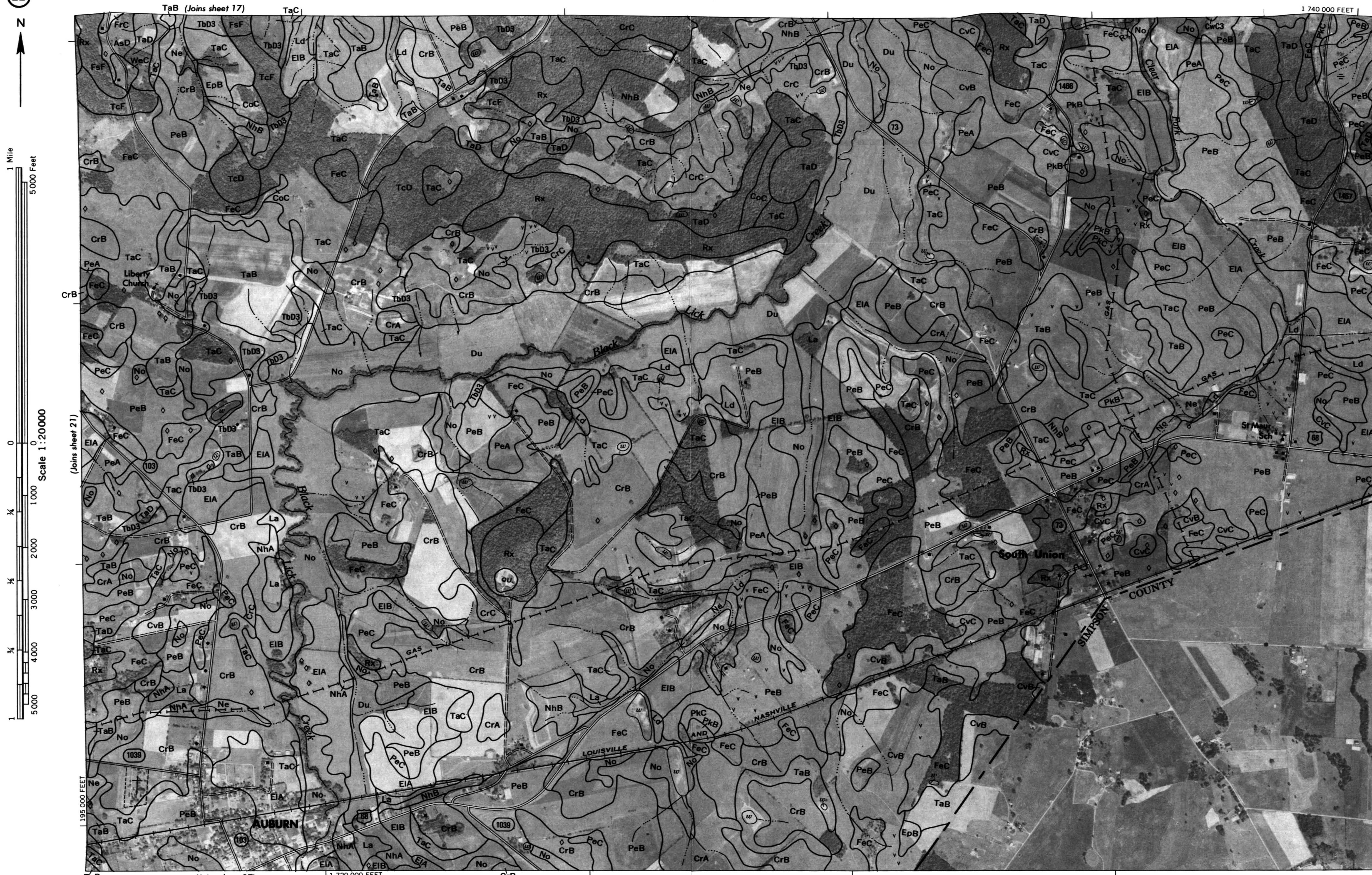
1 Mile
5 000 Feet
Scale 1:20000
0 ¼ ½ ¾ 1
0 1000 2000 3000 4000 5000

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

LOGAN COUNTY, KENTUCKY NO. 21

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

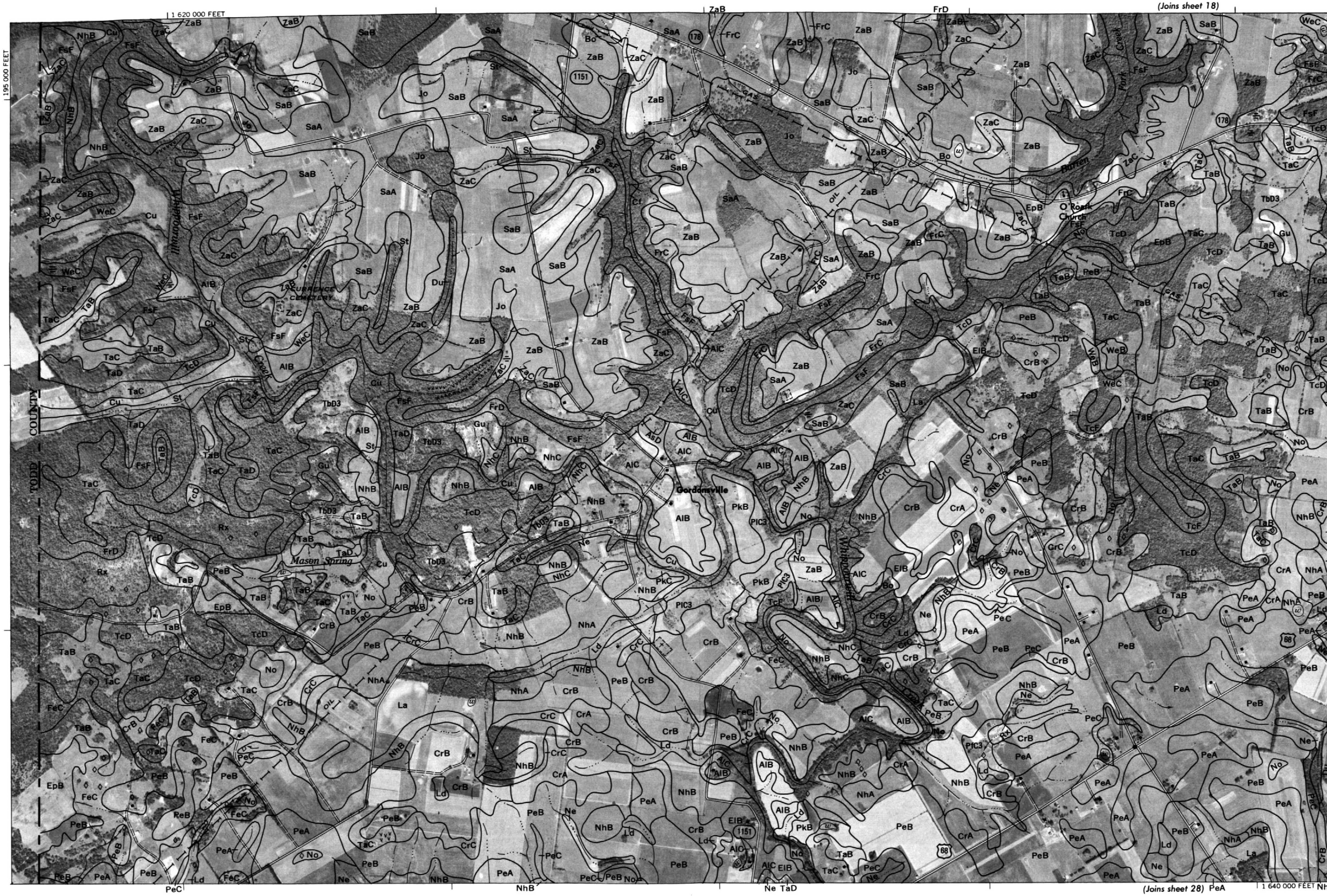
LOGAN COUNTY, KENTUCKY — SHEET NUMBER 22



Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

LOGAN COUNTY, KENTUCKY — SHEET NUMBER 23

23



N

1 Mile
5000 Feet
Scale 1:20000

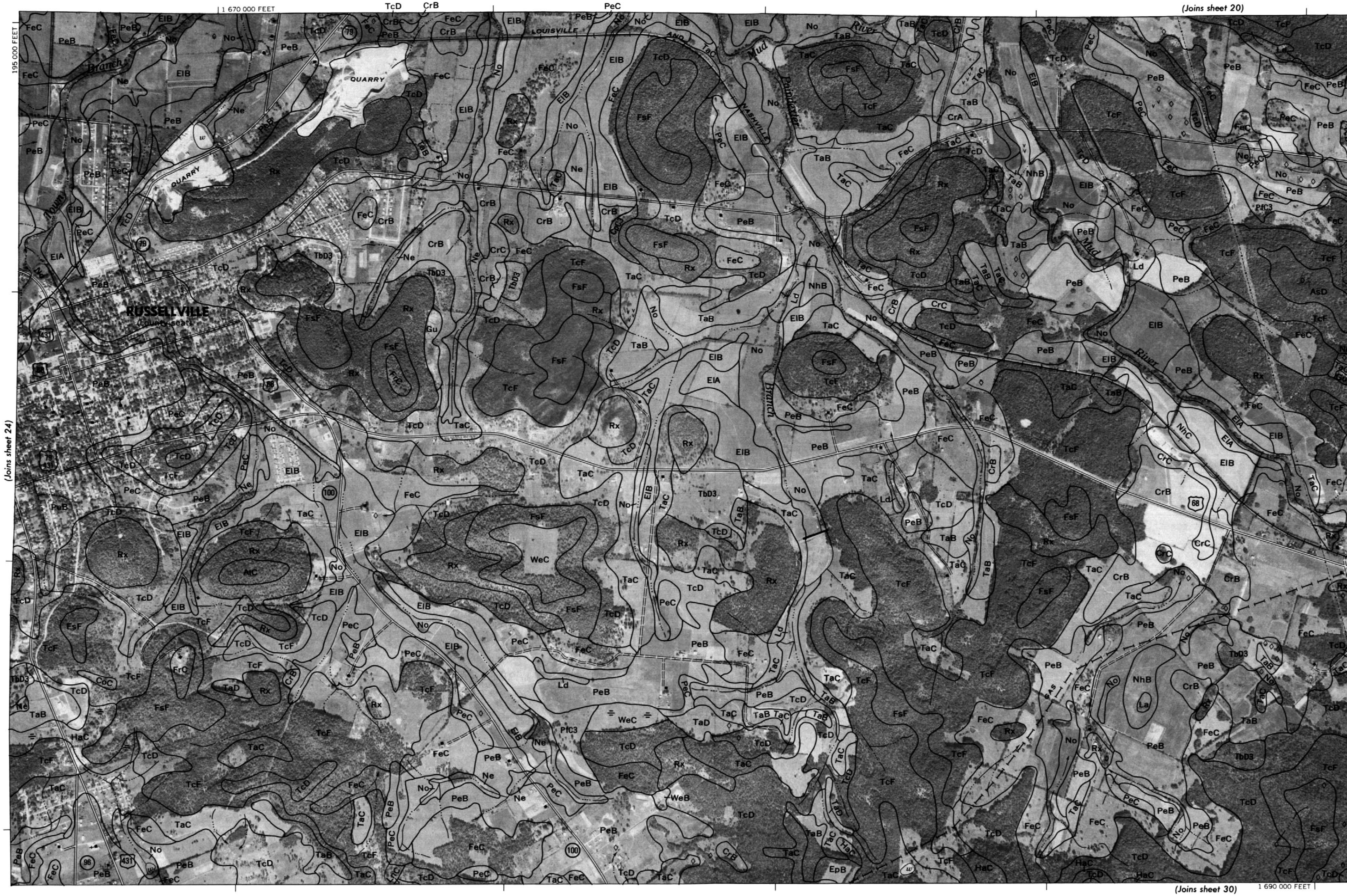
LOGAN COUNTY, KENTUCKY NO. 23

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

LOGAN COUNTY, KENTUCKY — SHEET NUMBER 24

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

25



N

1 Mile
5000 Feet
0
1000
2000
3000
4000
5000
0
¼
½
¾
1
Scale 1:20000

LOGAN COUNTY, KENTUCKY NO. 25

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station. Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

LOGAN COUNTY, KENTUCKY — SHEET NUMBER 26

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

LOGAN COUNTY, KENTUCKY NO. 27

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

28

LOGAN COUNTY, KENTUCKY — SHEET NUMBER 28

N

1 Mile
5000 Feet
Scale 1:20000
0 1000 2000 3000 4000 5000
0 ¼ ½ ¾ 1

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

LOGAN COUNTY, KENTUCKY NO. 29

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

LOGAN COUNTY, KENTUCKY — SHEET NUMBER 30

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

LOGAN COUNTY, KENTUCKY NO. 30

31

N

Scale 1:20000

1 Mile | 5000 Feet | 0 | 1000 | 2000 | 3000 | 4000 | 5000

LOGAN COUNTY, KENTUCKY NO. 31

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station. Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

N

Scale 1:20000

1 Mile

5000 Feet

0 1000 2000 3000 4000 5000

0 ¼ ½ ¾ 1

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

LOGAN COUNTY, KENTUCKY NO. 33

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station. Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

LOGAN COUNTY, KENTUCKY — SHEET NUMBER 34

N

(Joins sheet 29)

(Joins sheet 33)

(Joins sheet 35)

(Joins sheet 38)

1 Mile

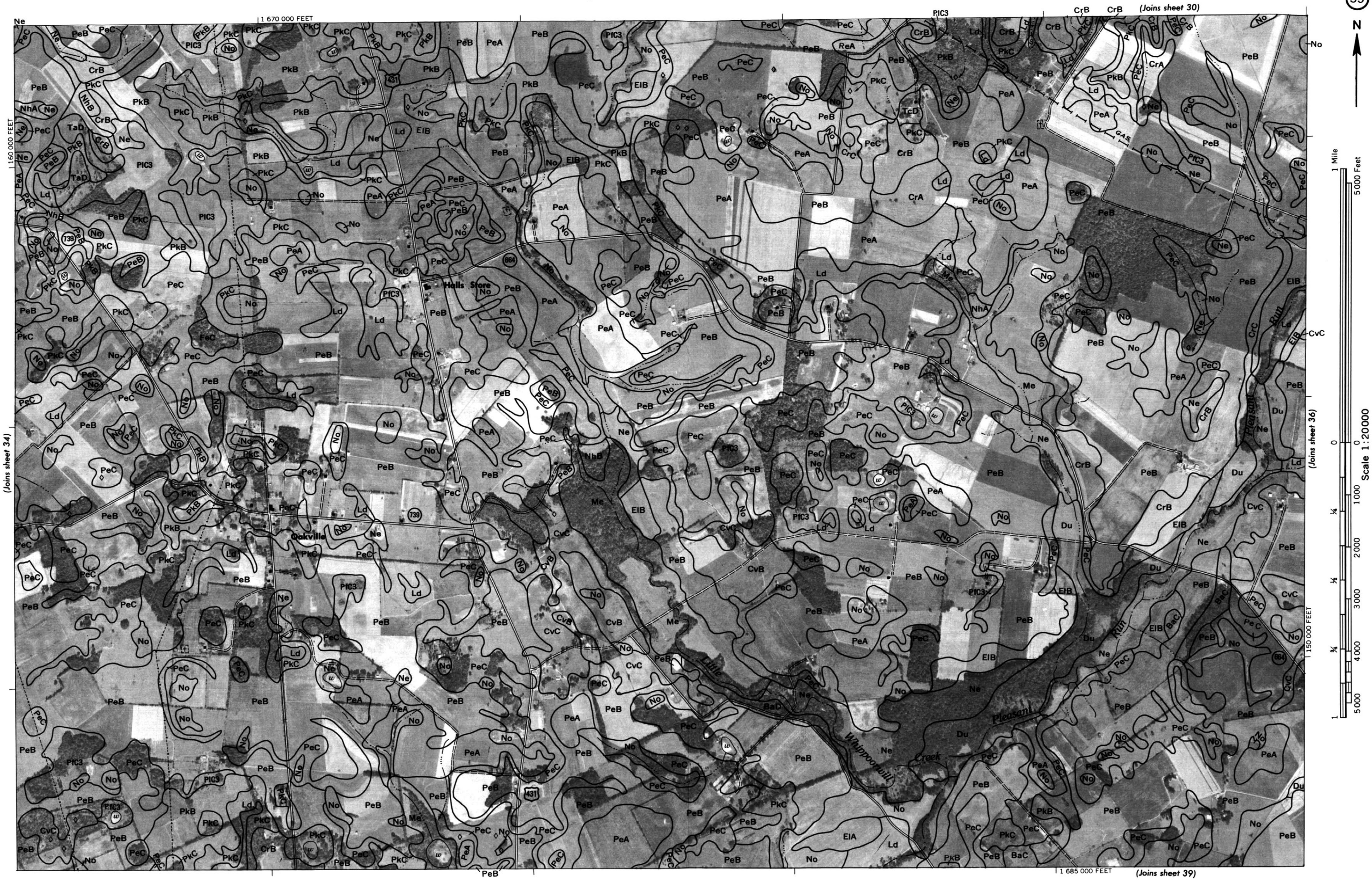
5000 Feet

0 1000 2000 3000 4000 5000

0 ¼ ½ ¾ 1

Scale 1:20000

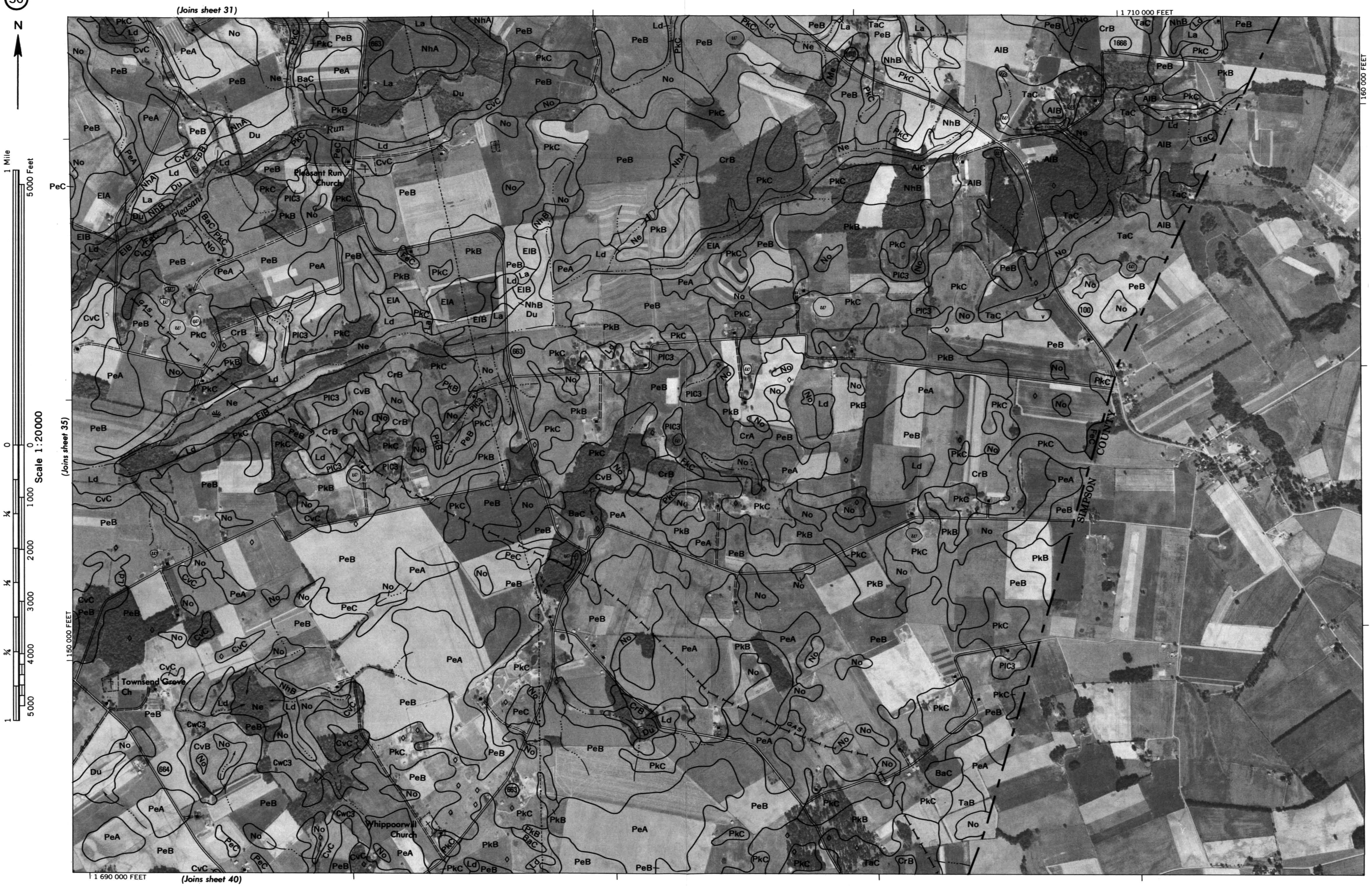
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.



LOGAN COUNTY, KENTUCKY NO. 35

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

LOGAN COUNTY, KENTUCKY — SHEET NUMBER 36



Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

N

Scale 1:20000

1 Mile

5000 Feet

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

LOGAN COUNTY, KENTUCKY NO. 37

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

LOGAN COUNTY, KENTUCKY — SHEET NUMBER 38

N

(Joins sheet 34)

Scale 1:20000

1 Mile | ¾ | ½ | ¼ | 0

5000 Feet | 4000 | 3000 | 2000 | 1000 | 0

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

LOGAN COUNTY, KENTUCKY NO. 39

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

LOGAN COUNTY, KENTUCKY — SHEET NUMBER 40

N

1 Mile
5000 Feet
0
0
1000
1/4
2000
1/2
3000
3/4
4000
1
5000

Scale 1:20000

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

LOGAN COUNTY, KENTUCKY NO. 41

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station. Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

LOGAN COUNTY, KENTUCKY — SHEET NUMBER 42

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

43

N

1 Mile
5000 Feet
0
0
1000
2000
3000
4000
5000
Scale 1:20000

LOGAN COUNTY, KENTUCKY NO. 43

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.

N

Scale 1:20000

1 Mile | 5000 Feet | 0 | 1000 | 2000 | 3000 | 4000 | 5000 | ¼ | ½ | ¾ | 1

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Kentucky coordinate system, south zone.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

LOGAN COUNTY, KENTUCKY NO. 44